THE MEDIUM FORMAT ADVANTAGE

ERNST WILDI

Focal Press

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Second Edition

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Ernst Wildi

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Preface

The majority of photographers do not start in the medium format. Most often they move up from a smaller film size, such as 35 mm, hoping to produce better quality pictures or more saleable images or to simply become more successful photographers. All this is possible, but only by being aware of the possibilities and limitations of the format and equipment.

There are also professionals normally working with larger negative sizes who move down to the medium format because of its convenience, faster shooting capability, and portability. This is happening more often today because of the superb definition of the modern color and black-and-white films. In the words of many photographers, large format image quality is now obtained on medium format roll film.

These trends of moving up as well as moving down have made the medium format truly the format in the middle. It combines many of the benefits of 35 mm photography with those of the large format, making a medium format system an excellent choice for almost all types of photography from candid action with a handheld camera to critical studio work from a tripod. Special chapters are devoted to these different applications and the type of equipment that most likely meets your photography needs.

You may also want to consider the medium format seriously if you see electronic imaging in the future. Some medium format cameras can be used for digital imaging by simply attaching a digital back to the existing camera in place of a film magazine. This allows using the same camera system with all the lenses and accessories for recording images on film or electronically.

Since a medium format camera may very well be used in so many different ways and applications, choosing the right system is of utmost importance. You need to choose a medium format camera with more care than you would a 35 mm camera because medium format camera

systems produce images in different formats and vary greatly in size, weight, design, and operation.

You should put a lot of thought into your choice of a camera because a move into the medium format can be a fairly costly undertaking if you are looking at a complete system with lenses, finders, and film magazines rather than just a basic camera. All components, especially the lenses, are larger and consequently more expensive than in 35 mm. This book explains clearly the medium format's benefits, advantages, and disadvantages and provides a comparison of the medium format to other formats so you can decide whether it is right for you and your photography. It lays out the different camera and lens designs and gives a photographer's view of which features are important for specific applications and in different fields of photography.

For photographers already working in the medium format, the book is a guide for using the medium format camera and its features to obtain the best possible image quality regardless of your field of photography or the purpose or use of the image.

The book is not a camera instruction manual. The instructions come with the camera and should be studied carefully before you start using the camera. Even expert 35 mm photographers should not assume that they know everything about the camera. Although some medium format cameras look and operate like 35s, some are quite different, especially if they feature interchangeable film magazines and lenses with leaf shutters.

There is one more objective I tried to accomplish: to inspire you to use your cameras, lenses, and accessories not just to record things as you see them, but to experiment and to use photography's unique capability to create a different world of images. Medium format cameras are well suited for creating images that are different from the way we see the world; they are, in my mind, the best and most versatile photographic tools for this purpose and for experimenting in many different ways.

CHAPTER 1

The History of the Medium Format

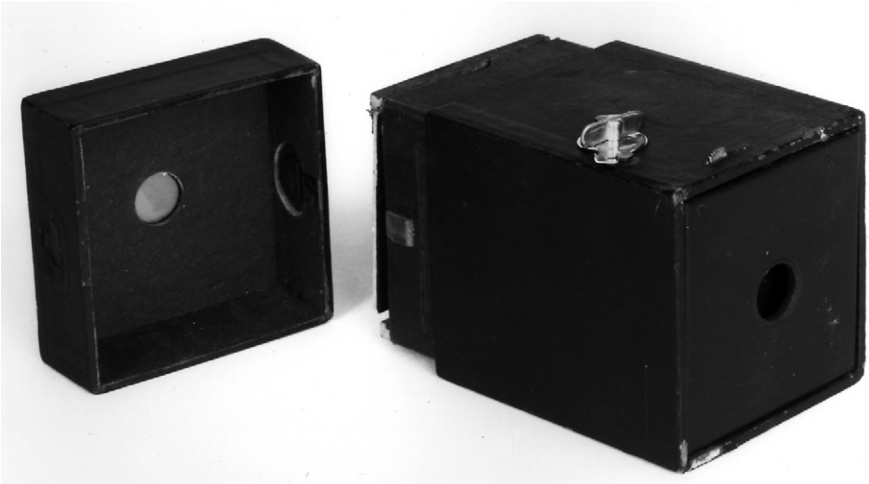
"Medium format" as it is defined today—"to categorize the film formats between 35 mm and the larger view camera formats 4 × 5 in. and up—"is frequently considered quite new.

But photography actually started with the medium format. The daguerreotype plates used in the 1840s were 6 1/2 × 8 1/2 in. large. But since silver and copper, the components of these plates, were very expensive, the image often did not cover the full size of the plate, so the plates were split into smaller sections (1/2 to 1/16) such as 2 3/4 × 3 1/4 in., 2 1/8 × 3 1/4 in., or 1 5/8 × 2 1/8 in. Judging from the large number of photographic images that have survived from this time, the 2 3/4 × 3 1/4 in. "medium format" was the most popular.

Roll film, which forms the basis for the design of the modern medium format camera, appeared in 1888 when George Eastman introduced the first camera with the Kodak name. The camera was factory loaded with roll film for 100 exposures, and the entire camera had to be returned to Eastman for processing the finished roll of film and for reloading. The image size on the negative was a 2 1/2 in. circle.

The medium format took a giant step toward becoming the most popular film format for years to come when the Box Brownie appeared on the market in 1900. Eastman hoped that with the price tag of $1, the camera would fulfill his dream to bring photography to every schoolchild. The Brownie also ushered in today's most popular medium format, the 2 1/4 in. square, which was produced in the Box Brownie on a cartridge of 117 roll film with six exposures. The cost was 15 cents.

In one of the early photographic promotion pieces, the Kodak camera was shown handheld to emphasize its compact size. Photographers simply aimed these early "handheld" cameras at the subject, because the cameras didn't have a viewfinder. Courtesy International Museum of Photography at George Eastman House.



The original Box Brownie made in 1900 with a 105 mm *f*/17 lens. The film support box at the rear was removable with a hinged panel in later models. Six 2 1/4 in. square images were produced on roll film. Cameras with the Brownie name were produced until 1965. Courtesy International Museum of Photography at George Eastman House.

The 120 roll film, which is the film mostly used in today's medium format photography, dates back to 1902, when it became a popular type for producing 2 1/4 × 3 1/4 in. images in Brownie and folding cameras. Other popular roll film sizes were (or still are) 127, introduced in 1912, and 620, which dates back to 1932. Brownie and folding cameras of many types and makes using the same type of film remained the amateur camera until the 1930s, to be replaced eventually by the twin lens types, and later by the single lens reflex (SLR)

There were twin lens reflex (TLR) cameras before 1900, but the TLR era was really born in 1929 with the appearance of the Rolleiflex. It was fast handling and compact, with a crank to advance the film. TLRs were immediately recognized as excellent tools, falling between the slow-handling larger format models and those using the small 35 mm film, which also established itself in the 1920s. Serious photographers recognized the Rollei advantages, and the camera became one of the most successful types of all time. The success also brought competition. Other companies, especially Zeiss and Voightländer, introduced TLR models. The success also brought about a Rolleiflex for the 40 × 40 mm format, today known as superslide.

By the early 1900s, Kodak promoted photography as a hobby for everybody everywhere. Female models were used, perhaps to emphasize that the camera had become so lightweight and so simple that everyone could operate it. The outdoor location emphasized that photography was no longer limited to the studio. Courtesy International Museum of Photography at George Eastman House.

A 1903 Kodak Model 3A folding pocket camera with Bausch & Lomb 170 mm $f/4$ lens with iris diaphragm. The waist-level finder was reversible for horizontal and vertical framing. A plate back accessory for ground-glass focusing and dry plates were available for some models. Courtesy International Museum of Photography at George Eastman House.

SLR cameras for large film sizes date back to 1880. In the 1930s, Graflex captured a large part of the market by introducing a small model with interchangeable lenses made for 10 pictures on 120 roll film.

A milestone in medium format camera design came in 1948 when Victor Hasselblad showed his 1600F model. It not only had a new medium format shape, but also was equipped with an interchangeable film magazine, which is the main attraction of the modern medium format SLR camera.

The panoramic image also started in the medium format. In 1899, Kodak introduced the Panoram-Kodak camera 4. It had a swinging lens producing a “large” 3 1/2 × 9 in. image on 103 roll film. The panoramic

camera design came down to a more normal medium format in 1900 with the Kodak 1 Panoram camera. It produced 2 1/4 × 7 in. images on 105 roll film. While there are various panoramic cameras for 120 and 220 film available today, the most popular panoramic camera, the Hasselblad XPan, produces an image 24 × 65 mm on 35 mm film. In a way, this camera can also be considered a medium format type since its image diagonal is equal to that of the 6 × 4.5 cm format and the camera's lenses are medium format lenses with a covering power for the 6 × 4.5 cm format.

In almost 150 years of photography, some film formats have disappeared completely or are no longer used in some fields of photography; others have appeared and gained in popularity. But the medium format has been in constant use in almost any type of camera and, today, is still the chosen film size for professional photographers working in almost every field, as well as for amateurs.

Today the medium format includes everything between the small format (35 mm and smaller) and the larger formats (4 × 5 in. and over) and is somewhat of a compromise between the two. It combines many of the conveniences of 35 mm with the benefits and advantages of larger studio cameras. That is the reason it is so popular and so valuable in almost all types of photography.

CHAPTER 2

The Medium Format Advantages

IMAGE SHARPNESS

Thirty-five millimeter and medium format cameras use the same type of black-and-white and color films. Because the medium format negative or transparency is anywhere from two and a half to four times larger in area than the 24×36 mm frame, its sharpness is proportionately better. To look at it in another way, the medium format negative can be blown up proportionately larger (to 30×40 in. instead of 16×20 in.) while retaining equal quality, assuming everything else is equal.

Since the quality, especially the sharpness, of films has been improved drastically over the last few years, some people have commented that the 35 mm image quality is completely satisfactory for any application where the medium format was originally needed or suggested; that it is no longer necessary to move up to the medium format. True, 35 mm negatives can today be enlarged to greater sizes without looking grainy or fuzzy. But since the same emulsions are used for both the 35 mm and the medium format, the same quality differences still exist between 35 mm and 120 roll film. The medium format image is still better.

In my mind, it is exactly the fabulous sharpness of today's films that is the best reason for moving up to the medium format. Medium format photography should be more attractive to the serious photographer because only the larger medium format images can truly convey the superb sharpness that is possible on these emulsions.

You will be greatly excited about the photographic image quality of the medium format when you examine the original 2 1/4 negatives or transparencies under a 10× magnifying glass and compare them with

35 mm originals. The 35 mm images might look great, but you probably would love to see the same image two and a half times to four times larger so you can really see the details that only the medium format image can reveal to you.

Prints made from almost any size negative are salable, and 35 mm transparencies are also accepted for most purposes, but the medium format images are still preferred or requested in many fields for advertisements and editorial purposes. By presenting the larger medium format transparencies, you will have a definite edge over your 35 mm competitors with many clients and art directors. You will convey a professional image and make a good impression on clients, who will be better able to see the results and determine how the image will fit into the advertising layout or design.

Although the 35 mm format cannot approach the sharpness of the medium format enlargement, or the beauty and effectiveness of a medium format slide presentation, image sharpness and effectiveness are not necessarily the major reasons for stepping up to the medium format. Other benefits of the medium format are even more helpful and valuable.

The larger medium format image can truly convey the quality of today's high-resolution films. Note the exceptional sharpness of the white window frames, which is maintained even in the 10× blow up on the next page.

It is the edge sharpness of such lines that conveys to our eyes the impression of sharpness.

IMAGE EVALUATION

It is often said that once you work in the medium format, you'll never go back to 35 mm, probably because the medium format negative or transparency is easier to evaluate. For example, when a 35 mm and a medium format negative or transparency are placed side by side over a light box, the effectiveness, even the quality, of the medium format negative can be determined more easily, usually with the naked eye. There is no need to use a magnifying glass except to determine critical sharpness. Cropping possibilities also can be determined effectively and accurately.

Medium format is also conducive to working with contact sheets, a favorite method of proof printing 35 mm and medium format negatives. Such proofsheets make it easy to compare images taken of the same subject or in the same location in order to select the best and decide on the final cropping. Differences in pose, lighting, expression, depth of field, composition, and even sharpness can be detected easily and usually without the use of a magnifying glass. The 35 mm contact proof images are frequently too small for this purpose. This is why many 35 mm photographers have the more expensive enlarged proofs made. The twelve 2 1/4 in. square or sixteen 4.5 × 6 cm images from a 120 roll film also fit well on a single sheet of 8 × 10 in. paper.

Proofsheets also provide a simple way for filing negatives. Negatives in their protective envelopes can easily be stored next to the proofsheet in a ring binder or filing cabinet.

The 12 images on the 2 1/4 in. square (above) or the 16 images on a 6 × 4.5 cm proofsheet are large enough to be evaluated carefully with the naked eye. Possible changes in the image format can also be determined easily. This is more difficult or impossible with 35 mm contact proofsheets (right). A 35 mm proofsheet also needs to be turned to see verticals and horizontals properly.

FOCUSING SCREEN

The focusing screen size must be among the medium format considerations.

On any SLR or TLR camera, the focusing screen is the size of the negative; consequently, the medium format focusing screen is anywhere from two and a half to four and a half times larger than its 35 mm counterpart. The larger screen does not necessarily provide more accurate focusing, but a more effective image evaluation, and you may be able to do so without needing to use a magnifying viewfinder.

Standard so-called waist-level finders, which allow two-eyed image evaluation, are available for square format medium format cameras. Using a waist-level finder, you can do a complete and accurate evaluation of the image while viewing the screen with both eyes open—as you would evaluate the final print or projected transparency.

I still believe that viewing the focusing screen with both eyes open is the best way to evaluate the effectiveness of the image or decide what might be necessary to make it more effective. Viewing with both eyes gives you a different impression from what you get by looking with one eye through a prism finder. Indeed, this might be the most important step in making you a better photographer.

One reason the square camera is such a popular medium format is because such cameras are always held the same way; they never need to be turned and thus can be equipped with any type of finder, eye level or waist level.

The large focusing screen of the medium format camera provides a view camera view on a compact camera and is helpful for composing and evaluating the effectiveness of the image.

CROPPING

For maximum image quality from any negative, the photographer must frame the subject or scene so that the entire negative, at least in one direction, can be used for the enlargement. A cropped negative must be enlarged more, which means there will be a decrease in the quality of the image. Cropping, however, is an important step in putting an image in its final form. Here the medium format can show its advantage and increased possibilities. Even if the photographer uses only about 30 percent of the

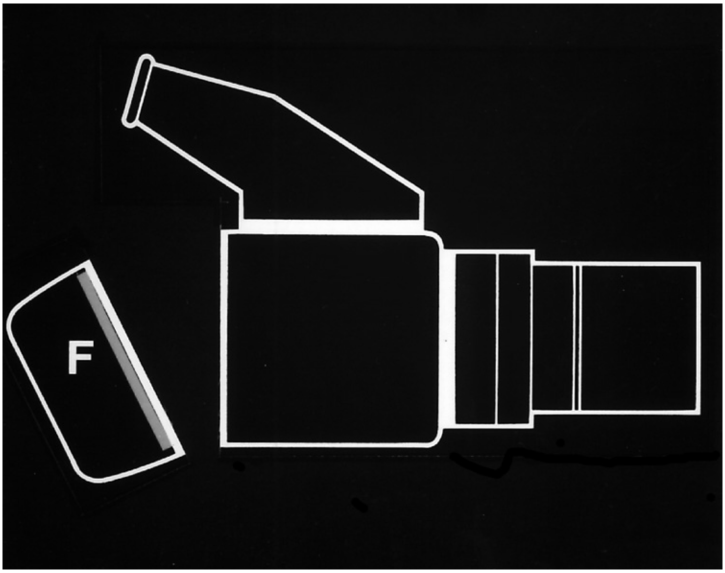
total medium format area, the negative can still be as large as the full 24 × 36 mm area of the 35 mm frame.

A square image offers even wider possibilities. You can leave it as a square or frame it into a horizontal or vertical, or into a panoramic image. You will undoubtedly start to see different compositions and different image shapes that you probably overlooked when evaluating the image on the camera's focusing screen. The possibility of easily changing a square into other shapes to fit a layout is also a major reason why art directors in advertising agencies often prefer or insist on receiving square images.

Even if you crop a 2 1/4 in. square negative about 70 percent, you still end up with a negative that is equal to the full size of a 35 mm frame.

FILM CHANGING

Various medium format cameras, especially SLR types, are designed with a completely removable film magazine. The film is not loaded into the camera, but into a magazine that can be attached to the camera or removed from it at any time without fogging the film. Several magazines can be pre-loaded, so changing from one roll to the next is almost instantaneous; therefore you are not likely to be loading film when the most important action is taking place. Using magazines is somewhat like carrying two or three loaded cameras, except you need only one



On various medium format cameras, the film is not in the camera body but in a separate film magazine, which can be removed at any time without exposing the film. Thus, film can be changed mid-roll.

camera and lens. You can also change from one type of film to another, from black and white to color, negative to positive, daylight to tungsten, high speed to low speed or instant, at any time. There is no need to finish the roll. Changing film can be done mid-roll without wasting a frame and without carrying more than one camera.

Changing film mid-roll can be one of the most important advantages and a major reason for selecting the medium format. It is, next to the larger film format, the major advantage of the medium format. It places the medium format one giant step beyond 35 mm for serious photography.

Most cameras are made for roll film for 10, 12, 16, 24, or 32 images per roll depending on the format or type of film. Roll film for medium format use does not provide the 36 exposures available in 35 mm film, but roll film is available with a sufficient number of exposures to limit film changing to a reasonable level of frequency. Roll film does not need to be rewound; thus film changing can be accomplished quickly. Several medium format cameras can also take 70 mm films with about 70 exposures on a daylight loading cassette, and even more "over 100" from a darkroom spool load.

INSTANT PHOTOGRAPHY AND ELECTRONIC IMAGING

Several medium format cameras also let you attach a Polaroid magazine. All you need to do is detach the regular magazine, even in the middle

of a roll, and attach the Polaroid magazine. You can then shoot one or several Polaroid shots and see the image within a minute or less.

Polaroid film shows the image exactly as you see it through the lens and confirms that everything in the camera works properly (that the flash is synchronized to the shutter, for instance). Nothing else can give you that peace of mind in important jobs. You can check exposure, lighting, and lighting contrast, which is especially valuable when you are working with multiple flash or when you are combining flash with daylight. The Polaroid image can also show things that you cannot see with your eyes or through a finder of any camera. For instance, you can see whether a certain shutter speed freezes or blurs moving subjects, and how much blur is created. You can see what a zoom shot or a camera-produced double exposure looks like or what effect a moving camera produces on the film. If you do professional work or are interested in creating images and not just recording objects as they exist, the Polaroid magazine is a great help. Other benefits of a Polaroid magazine are that you can show the client what the image will look like and get instant approval. You can also use the Polaroid shot as a teaching tool to show photography students the results of a shot instantly.

Some medium format cameras can also be equipped with a back for electronic imaging, which also allows you to see the image without the need for film processing.

SHUTTERS

Medium format cameras are in the front seat in regards to shutters, giving the serious photographer more choice between focal plane shutters, which are in the camera and move in front of the image plane, and leaf shutters, which are in the lens. There are even focal plane shutter cameras that can also be used with shutter lenses, thus offering the advantage of both types of shutters.

Focal plane shutters offer high shutter speeds going as high as 1/4000 second in the medium format. Not having to worry about a leaf shutter in the lens, the lens designer also has more freedom to play with the lens design, the focal length, the maximum aperture, and the focusing range.

With focal plane shutters, flash is synchronized only up to a certain shutter speed, and in this respect medium format types take a back seat to 35 mm cameras, some of which are synchronized with flash up to 1/250 second. The maximum shutter speed in the medium format is 1/125 second because the shutter curtain is larger and must travel farther. Some cameras only go to 1/30 second or 1/60 second, so check camera specifications closely if flash is important to you.

All leaf shutters can be used with flash up to their top speed, which is usually 1/500 second. Therefore, they are a better choice when flash synchronization at short shutter speeds is necessary or desirable, such as when photographing indoor sports or when combining flash with daylight.

Focal plane or leaf shutters can be completely mechanical or controlled electronically. Even if they function electronically, the actual opening and closing of the shutter is still a mechanical function.

CAMERA SIZE AND OPERATION

The large medium format negative or slide can be obtained with cameras that have many of the 35 mm benefits. While medium format cameras are somewhat larger and heavier, most are still lightweight and suitable for handheld photography. With most, you can also photograph as fast as with 35 mm cameras because shutter cocking and film advance is a single operation. Motor drives are available, although they do not operate as fast as 35s and do not allow you to shoot several frames per second.

The line of lenses available for medium format cameras is as extensive as for 35s. The lenses, however, tend to have somewhat smaller apertures than the 35 mm camera equivalent. Medium format cameras have become automated in many ways, especially with built-in exposure devices, and operating them is hardly more difficult than operating 35s.

Operating Automation

Medium format cameras are now available with automation in exposure and focusing that have been standard in 35 mm for some time and such features should be considered when investing in a medium format camera. Most medium format cameras have some method of metering the light in the camera, something that I consider a real benefit in most fields of photography.

At the same time, fortunately, medium format camera exposure and focus automation has not gone as far as it has on many 35 mm cameras. I purposely said fortunately because I hope that the automatic developments in the medium format will not go the 35 mm route with cameras offering a multitude of metering and focusing modes, sometimes indicated by the type of subject such as portrait, landscape, close-up, action, that might be more confusing than helpful to many photographers.

In addition, all these different exposure and focusing options need additional operating controls that must be set before you can take a picture and also need a display board so cramped with information that you can spend all your time worrying about technical details instead of concentrating on how to create an effective image. Perhaps all these different options are supposed to eliminate the need of the photographer learning something about exposure and metering.

I still feel that photographers can produce better results in a fraction of the time by learning the principles of exposure and working with a simple built-in metering system that measures the light in one specific way—often creating better pictures the old fashioned way.

CHAPTER 3

Image Formats

SELECTING THE FORMAT

In the medium format, different cameras produce different image formats, so it is worthwhile to determine which format serves which purpose best.

Professionals use the medium format camera daily or at least a few times each week. Your choice of image format is important because the medium format camera is likely to become the photographic tool you use the most. When you choose a camera, price should not take precedence over the camera's format and design characteristics.

The format decision for the camera should not even be based on the desired image shape of the final picture. For example, you should not choose a camera that shoots rectangular images simply because you or the client prefer such images over square ones. A rectangular format camera is a fine choice if it has all the features that are important in your photography, or if shooting rectangular pictures does not carry with it some inconveniences. On the other hand, shooting with a square format camera and then changing the image shape later might be a more satisfactory solution especially since the medium format negative is so large and provides excellent cropping possibilities. Rectangulars can be changed into squares, but only by sacrificing image sharpness. Squares, on the other hand, can be converted into rectangles without loss of image quality. The rectangular shape of enlarging papers should definitely never be a reason for selecting a camera that shoots rectangular images to match the paper format. Instead, give serious consideration to the following points when choosing the format of a camera:

1. the convenience of viewing and focusing and holding the camera in handheld photography;
2. the size and weight of the equipment, if you plan to use it on location;

3. the camera features; shutter, flash synchronization, available lenses, and accessories;
4. the availability and degree of interchangeability of film magazines and the emulsions that can be used;
5. the possibility of attaching a Polaroid film magazine and a magazine for electronic imaging;
6. the convenience and speed with which you can operate the camera and lenses; and
7. the availability of compatible projection equipment if slides are to be produced.

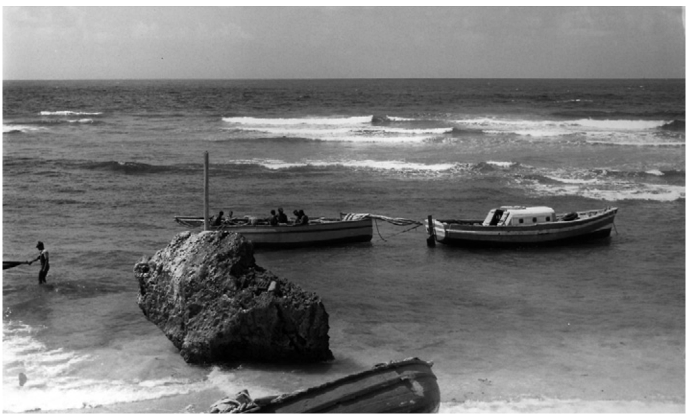
Various medium formats compared. The 2 1/4 in. square with 3020 mm^2 (1), the 2 1/4 $\times$ 2 3/4 in., which is about 3850 mm^2 (2); the 6 $\times$ 4.5 cm with an area of 2200 mm^2 (3); the 6 $\times$ 9 cm with a 4760 mm^2 area (4); and 6 $\times$ 8 cm with an area of 4370 mm^2 (5). All are considerably larger than the 35 mm frame (6).

(1)

(2)

(3)

(6)



(4)

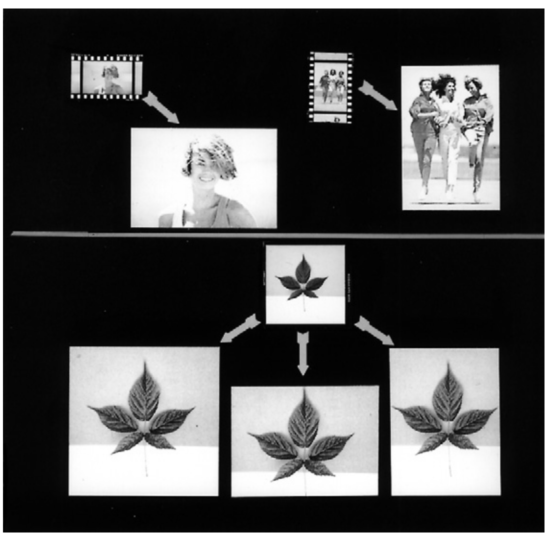
(5)

2 1/4 × 2 1/4 in. (6 × 6 cm) Square

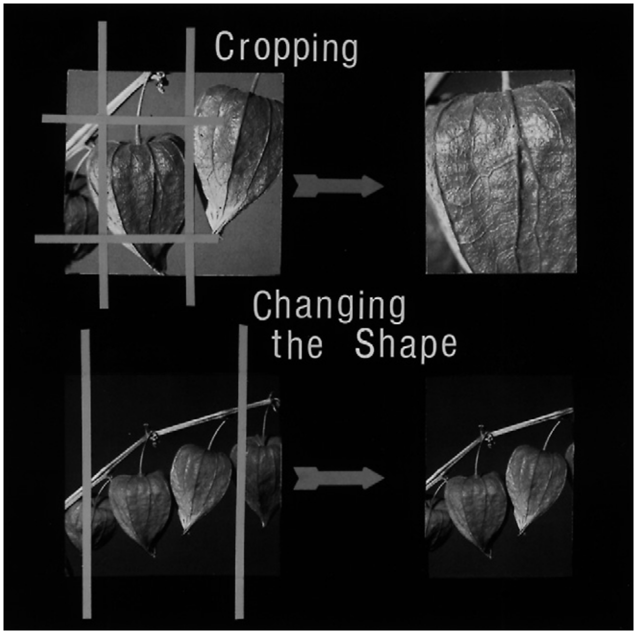
Many photographers associate the medium format with the square, probably because the 2 1/4 in. square has been the most popular medium format in the last three decades. (It is also known under the metric measurement of 6 × 6 cm. indicating centimeters.) The actual negative size, however, is not 6 × 6 cm, but slightly less, or about 55 × 55 mm. Twelve images fit on 120 roll film, 24 on 220, and 70 or more on 70 mm perforated film, which requires a special magazine.

The 2 1/4 in. square format can be found in SLR, TLR, and wide angle medium format cameras Some cameras offer a second choice of a smaller rectangular format.

Square cameras are sometimes a second choice or are not considered at all by photographers who know that their negatives end up as rectangular prints and who do not want to waste part of the negative. It is, of course, always desirable to fill the negative so the entire area is usable in the enlargement. But changing a square into a rectangle does not mean enlarging it more than you would enlarge a rectangular negative because the degree of enlargement is determined only by the long side of the negative, not the negative area. The long side remains the same; thus the 2 1/4 in. square cropped to a rectangle has to be blown up exactly the same as the full 6 × 4.5 cm negative.



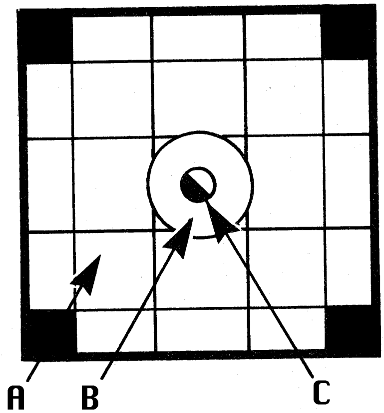
A 35 mm image produced as a horizontal most likely remains a horizontal as a print and a 35 mm vertical frame probably remains a vertical (top). An image produced as a square in the camera on the other hand may remain a square or may be presented as a horizontal or as a vertical. You, therefore, should not necessarily "think square" when working with a square format camera (bottom).



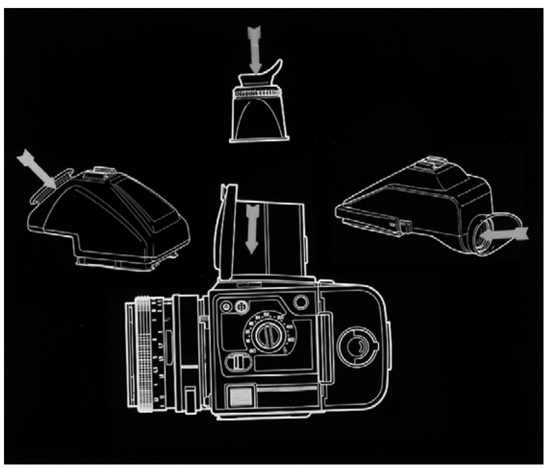
When changing a square original into a vertical or horizontal, you simply change the shape of the image. The image remains the same size and you, therefore, do not lose quality. Cropping means using a small portion of the original and enlarging the subject with a consequent loss of sharpness.

Photography with a Square Camera. The square camera is designed for the greatest operating ease and convenience, so there is no need to decide whether to hold the camera for horizontals or turn it sideways for verticals. There are also advantages when working from a tripod or working with portable flash. The camera always sits on the tripod the same way. No need to tilt the tripod head and no need to move the portable flash. It is always in the same position above the camera lens.

The real benefit of shooting square, however, is in viewing. A camera that needs to be turned for verticals must be equipped with a 90 prism finder, since such a finder is the only practical viewing method when the camera is turned. Such a camera thus becomes an eye-level camera that must always be held in front of your eyes. The square format camera, on the other hand, can be equipped with eye-level finders—a 45° prism finder—or a waist-level type for viewing directly from the top. The square format camera gives you much more freedom, allowing you to photograph from practically any angle easily. The benefits of not having to turn the camera can also be obtained with a 6×7 camera with a rotatable film magazine, but only by compromising on size and weight.



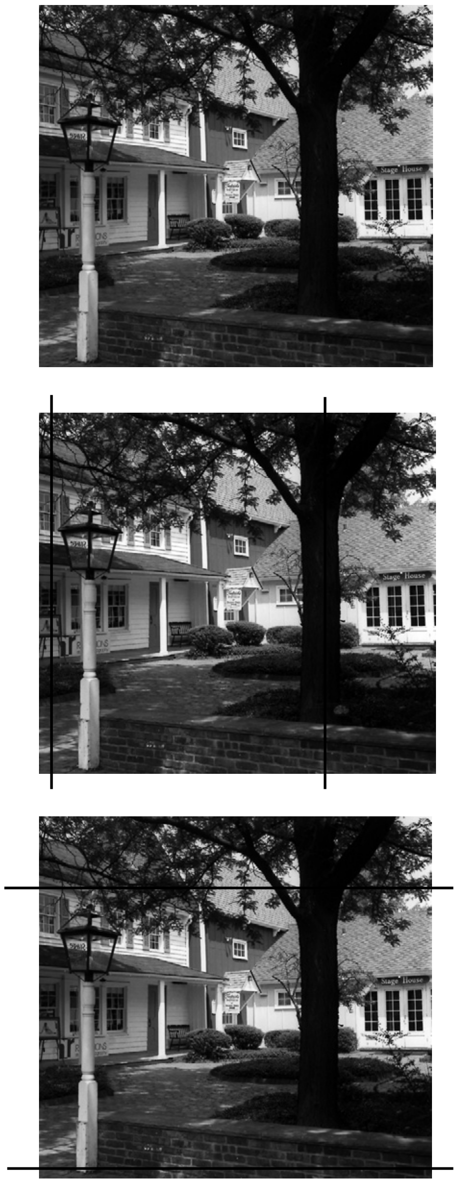
The guidelines on so called checked screens may correspond to the rectangular paper proportions. The framing area becomes more obvious by darkening the four corners with translucent tape or colored foil. If the screen has a microprism and/or split image rangefinder, the image can be focused either on the screen (A), the microprism (B), or with the rangefinder (C).



Since a square format camera never needs to be turned, you have the option of viewing the focusing screen image from eye level with a 90-degree eye-level finder, with a 45-degree prism viewfinder or from above the camera with a folding type focusing hood or a magnifying hood.

Square Prints. Instead of changing square negatives into rectangular prints, why not crop the rectangular paper to make square prints? The final print format must be a personal decision, but square prints can be very effective for just about any purpose, as are square transparencies in projection.

Square prints make for attractive wedding or display albums. Every print fits the square album page with an even border, looking like a framed picture. Twelve square images can be contact proofed on one sheet of 8 × 10 in. paper. All images are right side up, so viewers need not turn the sheet.



Square images provide a lot of freedom in cropping. Subjects can be composed to make good squares (top), verticals (middle), or horizontals (bottom).

Square slides make an effective slide presentation, with each image taking up the same space and filling the full area of a square projection screen. Audiovisual professionals believe that a presentation with square images is more effective than switching between verticals and horizontals. Slide mounts for 2 1/4 in. square images are readily available.

Since many images from professional photographers are used in a rectangular version, especially when they are used on covers of magazines, photographers often like to submit to the client or art directors images in the rectangular, usually vertical format. By submitting rectangular images, photographers may prevent or reduce other cropping choices the art director may have in mind. The methods for producing rectangles in square format cameras are discussed under the heading "6 × 4.5 in the Square Format Camera."

The 6 × 4.5 cm Format

The true negative size of the 6 × 4.5 cm format is about 40 × 55 mm. Some medium format cameras are made specifically and only for this format. On others, you can choose this format by attaching a separate magazine, thus you have the choice of shooting squares or rectangles. The 6 × 4.5 cm negative has an aspect ratio that is almost identical to 8 × 10 in. and 16 × 20 in. paper; thus the full negative can be printed. The degree of enlarging you need to do when making a rectangular print is the same for the 6 × 4.5 cm format as for a 2 1/4 in. square cropped along one or two sides. Consequently, there is no benefit to using the 6 × 4.5 cm format as far as image quality is concerned.

The benefit of the 6 × 4.5 cm format is in the larger number of exposures per roll of film. Sixteen 6 × 4.5 cm. images fit on the same film length as twelve 2 1/4 in. squares if the images are equally and properly spaced. This is not the case on some 6 × 4.5 cm cameras where manufacturers have cut production costs by eliminating the rather complicated mechanism that provides even frame spacing on the unperforated roll films. As a result, such cameras only give 15 exposures on a roll of 120 film. The three or four additional exposures per roll in the 6 × 4.5 format are a benefit. The film costs are 20 to 30 percent lower. All 6 × 4.5 cm format cameras must be turned for verticals, so viewing becomes limited to the 90° eye-level finder. This limitation must be considered carefully.

The 6 × 4.5 cm format is frequently referred to as the ideal format, but that does not necessarily mean that it is ideal for photography. It simply means that the format has the same aspect ratio as the 8 × 10 in. enlarging paper. Whether the format or the 6 × 4.5 cm camera is ideal is up to each individual photographer.

The 6 × 4.5 cm in the Square Format Camera

Square format cameras with interchangeable film magazines usually can be equipped with a film magazine for the 6 × 4.5 cm format.

Depending on the manufacturer, such a magazine produces 15 or 16 images on a roll of 120 film, twice as many on 220 roll film. Horizontals can be obtained in the normal camera position; for verticals the camera needs to be turned.

To make it still easier for the square shooting pro to produce rectangulars, some manufacturers now have available masks that can be inserted into the back of square cameras. They give the photographer the option of producing squares, horizontals, or verticals. You receive the same number of exposures in all formats—12 on 120 and 24 on 220 film—but you need not turn the camera. You simply turn the mask. Using the mask also produces the proper image format on the Polaroid test shot, which is helpful when the test shot is presented to the client or art director for final approval while shooting.

The 40 × 40 mm Format

The 40 × 40 mm format, known as superslide, used to be fairly popular because the images it produces could be projected in a standard 35 mm slide projector. Special superslide film magazines were available for some cameras. But this format has been discontinued because most modern 35 mm projectors no longer project these larger slides with proper corner to corner quality and illumination.

To produce superslides today, make the images in a 6 × 4.5 mm film magazine, then cut the long side to produce a square.

The 6 × 7 cm (2 1/4 × 2 3/4) Format

This largest of the more popular medium formats also has an aspect ratio that closely resembles that of the popular enlarging papers. The actual negative size, about 56 × 68 mm, makes the image visually very effective and large compared to the smaller formats. However, you must first consider that only 10 negatives fit on one roll of 120 film—two fewer than 2 1/4 in. squares, and five or six fewer than in the 6 × 4.5 cm format. The film cost is thus 20 to 60 percent higher, and you will need to change film more often. More important are the size and weight of the camera. This larger negative can be obtained only on cameras specifically made for this format, which consequently have to be larger and heavier.

On some 6 × 7 cm cameras horizontal and vertical images are obtained by turning the camera; on others this is done with a rotatable film magazine that also changes the format aspect on the focusing screen.

The 6 × 7 cm format is not practical for contact proof printing because only 9 of the 10 images from a 120 roll film will fit on an 8 × 10 in. sheet of paper. This is a relatively unimportant consideration since most 6 × 7 cm photographers do not contact print their negatives but have individual proofs made instead.

The full 6 × 7 cm format shot can be projected only in a special slide projector. Other possibilities are to cut the rectangle down to a 2 1/4 in. square or a 6 × 4.5 cm rectangle for use in 2 1/4 in. slide projectors.

The 6 × 8 cm Format

The 6 × 8 cm medium format first appeared in 1986. It is presently available from only one camera company that promotes it as the format that provides the most effective vertical/horizontal ratio. The image size is 56 × 76 mm. Considering the 8 × 10 in. paper proportions as standard, the 6 × 8 cm format needs some cropping at the long side. You obtain nine exposures on 120, 18 on 220 film. The nine exposures can be contact printed on an 8 × 10 in. proofsheet.

COMPARING FORMATS

All the formats discussed up to this point are good choices for any type of medium format photography in the studio and on location. Image format, therefore, should not completely or mainly influence your choice of camera. You are more likely to make a wise choice by carefully considering the camera operation and handling, its features as they relate to your type of work, the reputation of the manufacturers, and especially camera size and weight.

If all your work is done on a tripod in the studio, size and weight need not be a factor. To me, however, a medium format camera was never meant to be a studio camera. Referred to as the "camera in the middle," it is supposed to be a camera that is great for critical studio work and equally well suited for location photography, handheld if desired or necessary. That is exactly how most professionals use a medium format camera. Amateurs do even less work indoors, using their cameras mainly during their travels and for nature work. This is why I feel that choosing a medium format camera system has everything to do with size. Not just the size of the image, but also the size and weight of the camera. To get an image in the 6 × 7 cm format that is only one centimeter longer (approximately 20 percent), than the 2 1/4 square or an image in the 6 × 4.5 cm size, you may have to carry a camera that weighs as much as 80 percent more.

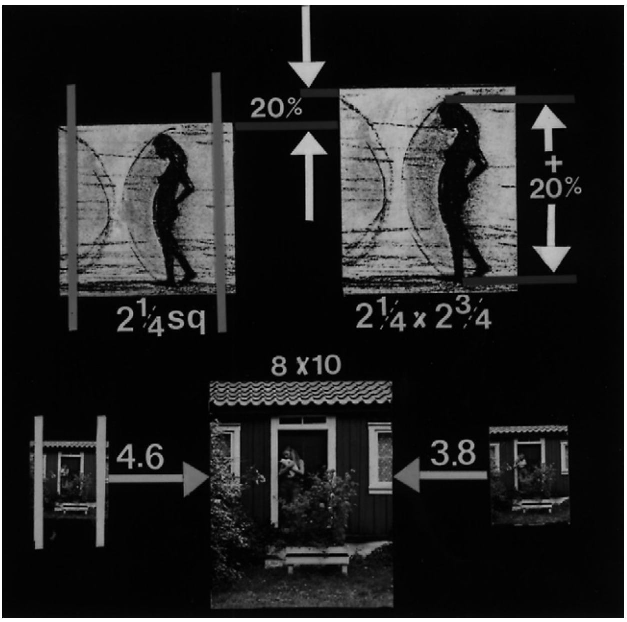
Consider the matter of camera size and weight very carefully if you're looking for one medium format system that can do it all. A light, compact camera will handle your most critical studio work, yet handheld on location, it can be as much of a pleasure to use as a 35 mm camera.

One of the greatest benefits of the medium format is that it is a great format for any type of photography. A good compact, lightweight medium format camera system can serve all purposes in the studio and on location (for example, studio portraiture and candid wedding work) and eliminate the need for owning and operating two different systems.

When comparing different formats, it is also essential that we differentiate between the film area and image size. Film area is important in visual observation of a negative or transparency on a lightbox or in the size of a projected image. For these purposes, it is proper to call an image twice as large when the area is twice the size. Area, on the other hand, cannot be used to compare image size or necessary degree of enlargement. The length of the negative side must be used for this com-

parison. For example, the 6 × 7 cm film area is about 60 percent larger than 6 × 4.5 cm, but the difference in image size or degree of enlargement is only about 20 percent.

In a full-length portrait, for example, the model is only about 20 percent larger on 6 × 7 cm compared to either the 2 1/4 in. square or the 6 × 4.5 cm format. The larger image made retouching the original 6 × 7 cm negative or transparency somewhat easier. This is however no longer a factor today since most retouching is done digitally. The same is true of the degree of enlargement. The 6 × 4.5 cm negative, or the 2 1/4 in. square cropped down to the 8 × 10 in. paper proportion, must be enlarged only 20 percent more than the full 6 × 7 format image to obtain the same size enlargement.

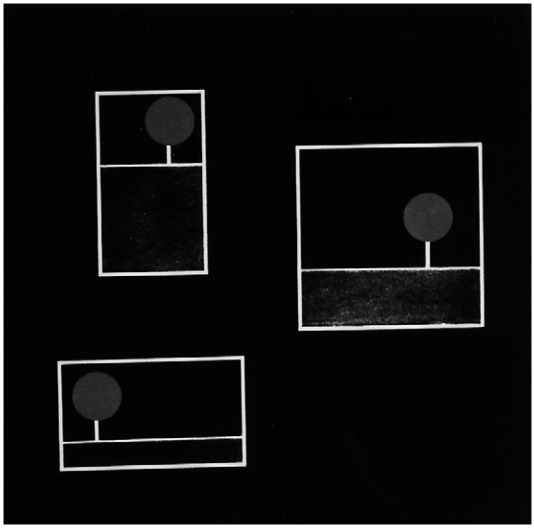


The film area of a 6 × 7 cm negative (right) is about 60 percent larger than the 6 × 4.5 cm area out of a 2 1/4 in. square (left), but the size of the subject recorded on the 6 × 7 cm image is only about 20 percent larger. Image size is determined by the long side of the negative, which is 20 percent (68 mm versus 56 mm). The difference in the degree of enlargement is also only 20 percent.

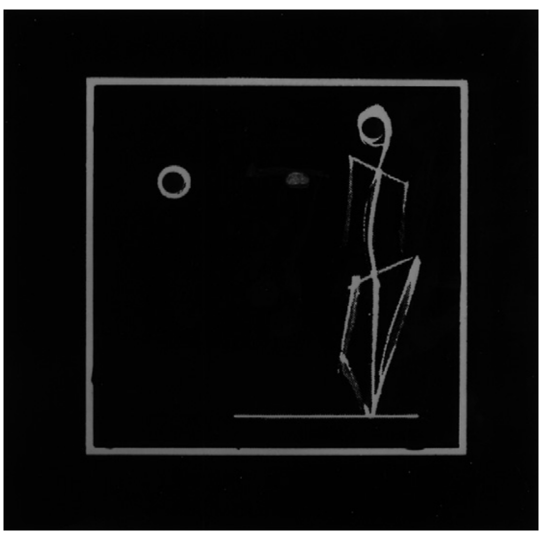
IMAGE SHARPNESS

Assuming that everything else in the camera such as the performance of the lens, the film flatness, the accuracy in the mirror and screen alignment are equal, the 6 × 7 cm image should be about 20 percent sharper; or to say it in a different way, the larger negative should allow for a 20 percent higher blowup of the image while retaining equal image quality. This, however, has not proven to be the case. Film tests made by

photographic magazines and photographers seem to indicate that the 6 × 7 cm format yields images that are not noticeably better or not at all sharper compared to a good 6 × 4.5 cm image cropped from a 2 1/4 in. square. Therefore, better image sharpness should not be a reason for selecting the larger format.



The same suggestions for good composition, such as placing main lines and main subjects approximately one third from left or right and one third from top or bottom, apply in squares as well as in rectangles.



Main subjects placed to one side of the image require a balance on the other side in any image format.

OTHER MEDIUM FORMATS

The 6 × 9 cm Format

One of the original popular medium formats has not disappeared. The 6 × 9 cm (2 1/4 × 3 1/4 in.) format producing eight images on a roll of 120 film is still here, but only in press and aerial cameras, in rangefinder and wide angle types, and is used in special roll film magazines for view and press cameras.

Since standard roll film is used in most 6 × 9 format cameras, the same wide choice of film available for the more popular medium formats is also available for this format.

The 6 × 9 cm format has the same 2 × 3 proportions as the 35 mm image. Neither matches the 8 × 10 in. paper proportions. The long side must be cut.

Panoramic Formats

Although the usable width of roll film limits one side of the image to 56 mm, the other side of the image can be stretched along the film as far as the lens is capable of covering. That is what is done in panoramic cameras where the format ranges from 6 × 12 cm (six images on a roll of 120 film) to a format that is almost three times longer than it is wide: 6 × 17 cm (2 1/4 × 6 3/4 in.) with four images per roll of 120 and eight on 220. The film area of the latter is equivalent to three 2 1/4 × 2 1/4 in. images.

The panoramic formats may mainly serve to capture an area wider than is possible with a wide angle lens on an ordinary format, but also offer a new way of creating visually dramatic images with excellent overall quality.

Panoramic images also have a lifelike appearance; they are closest to the way we see. Panoramic cameras can take into one picture the wide horizontal sweep that we can see with our eyes from the top of a mountain or building, a lakeshore, beach, or city street. Since normal viewing is horizontal, these cameras are most often used for horizontals. The camera can be used for verticals and can be excellent for enhancing the height of a waterfall, tall trees, or buildings.

Panoramic medium format cameras need to be larger, but still can be used in handheld camera work. They are usually equipped with a spirit level to ensure straight horizontals or verticals. The film gate and pressure plate in such cameras must be designed to keep the large negative area flat from one side to the other.

Negatives from panoramic cameras cannot be enlarged in an enlarger that is equipped for the typical medium formats. The 6 × 12 cm negative requires an enlarger made for 4 × 5 in., and a 5 × 7 in. type is needed for the even larger 6 × 17 cm negative.

Masks are available for some medium format cameras to produce panoramic images within the 2 1/4 × 2 1/4 in. image area. There is not much benefit in using such a mask however if the film is advanced in the normal fashion. You do not obtain more images on a roll of film so you might as well take them in the 2 1/4 square or 6 × 4.5 cm format

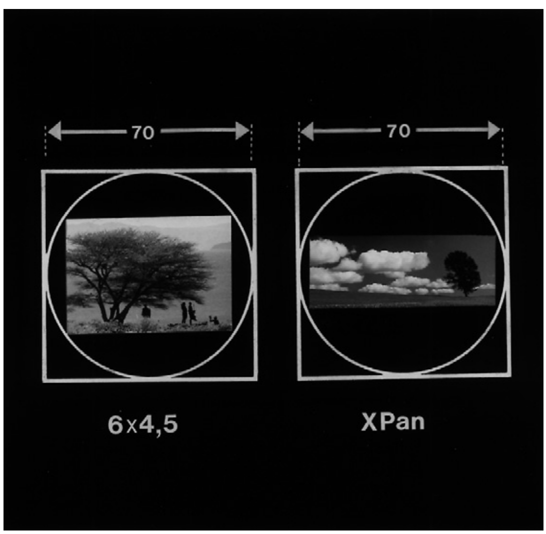
and cut them into panoramas afterwards. You might be able to produce 22 to 24 panoramic images on a roll of 120 film, however, by using the camera's winding crank only to recock the shutter and advancing the film with the winding crank on the film magazine.

Panoramic photography has become popular with the introduction of the Hasselblad XPan camera, which has the size and weight of a 35 mm camera. While this camera uses 35 mm film, the image format with the long side of 65 mm (24 × 65 mm) can be considered a medium format, and the camera's lenses are designed to cover the 6 × 4.5 cm image format.

35 MM IN THE MEDIUM FORMAT CAMERA

The combining of medium format photography and 35 mm film has been made possible by some manufacturers who supply a 35 mm film magazine for medium format cameras. This innovation was never meant to encourage the use of 35 mm film in a medium format camera. Most photographers are better off using a good 35 mm system when 35 mm is needed.

The idea for a 35 mm magazine goes back to the time when Kodachrome film was available only for 35 mm, and some photographers or art directors insisted on this type of film. With the great choice of superb color transparency films available today, this application has lost its value at least for producing images in the standard 24 × 36 mm size. Some manufacturers, however, have a 35 mm magazine for producing panoramic images on 35 mm film in a medium format camera.



While produced on 35 mm film, the 24 × 65 mm image of the XPan camera can be considered a medium format as its image diagonal is equal to that of the 6 × 4.5 cm medium format.

CHAPTER 4

Films and Film Loading

GENERAL COMMENTS

Most black-and-white, color negative, and color transparency films made for medium format cameras are identical to those made for 35 mm cameras. They are also processed in the same fashion. Thus, for those photographers who have previously worked in the smaller format and are changing to medium format, selecting film is simple. In most cases, the film that you would use in the 35 mm camera is also the logical choice in medium format roll film.

Photographers who frequently work in low light situations with lens apertures of $f/1.4$ or $f/2$ on their 35 mm cameras may be better off switching to a faster medium format film if such exists. The reason is that medium format lenses are slower, and a faster film will make up for a slower lens. $F/2$ lenses do exist for some medium format cameras, but for most the maximum aperture of the standard lens is $f/2.8$ and even slower on the wide angles and telephotos.

Depth of field is another reason for considering a faster medium format film. When covering a certain size area, the magnification in the medium format is higher than on 35 mm. Depth of field is directly related to magnification. The higher the magnification is, the shallower the depth of field at a specific aperture. Covering a 36 mm long subject with a 35 mm camera means 1× (life-size) magnification. To cover the same area on the 6 × 4.5 cm format means a 1.5× magnification requiring an aperture 1 to 2 stops smaller for the same amount of depth of field.

By using 400 ASA film to capture the medium format image, you can achieve the same depth of field as with 100 ASA film in 35 mm,

using the same shutter speed in both. This approach can be especially valuable in close-up photography and is usually not a disadvantage especially when considering the difference in the image size.

With the high quality of today's films, one should not hesitate to use the faster films. The fast films might allow handheld photography where otherwise a tripod would be necessary. More important, faster films allow you to use shorter shutter speeds and thus reduce the possibility of camera shake.

Wedding photographers have started to use 400 ASA color negative films instead of 100 ASA, The faster films also allow them to use a more compact, lighter flash unit.

Generally, however, for optimum sharpness, it is still better to use the slowest film that can do the job and to select the faster ones only when necessary. Slower medium format films tend to have a higher resolution and finer grain, thus producing a sharper image. They are the obvious choice when sharpness is your main goal or when the negative is to be enlarged tremendously or will need extensive cropping.

Switching from slow to fast films and vice versa is greatly simplified in medium format cameras that offer interchangeable magazines. You can load two or three magazines with different films and then switch from one to the other in the middle of a roll. Thus, you are always in the position to use the film that is best for each subject while carrying only one camera. Those interested in experimenting in the darkroom should not overlook many of the films made for special purposes, such as high contrast photography, copying, and photomicrography.

Amateur and Professional Film

Color negative and color transparency films made by the major manufacturers come in an amateur brand and a professional brand with the same or a completely different name. The only difference between the brands is in the aging process of the film. The colors in an undeveloped film are not perfectly stable; they shift somewhat as the film is stored. Professional film is pre-aged at the factory so it produces the correct color when delivered to the store. To remain in this condition, the film must be refrigerated until about an hour before it is used. If the finished roll is not processed immediately after being exposed, it should again be refrigerated, if possible. Professional films are made so that the professional can count on matched colors and exposure from roll to roll.

Amateur film is delivered to the store in a state where it produces the correct color after it has been stored at normal room temperature for four to six months. Manufacturers have found that this is the average time that elapses from the moment the film is made until it is actually used. Amateur films need not be refrigerated, which can be an advantage when you are taking photos while traveling, but the colors in such films will vary somewhat based on the storage time and temperature.

The choice of amateur or professional film may also be determined by the laboratory. "Amateur labs" may not process professional films or medium format films in general.

Producing the Black-and-White Negative and Print

In addition to camera steadiness, accurate focusing, lens quality, and film flatness, the sharpness of the black-and-white negative is also affected by exposure and development. Overexposure and over-development increase grain size and thus reduce apparent sharpness. A thin negative that has just enough shadow detail makes the sharpest print.

Too little exposure causes loss of shadow detail. In a good print, the lighter subject tones in the shadows must show detail for the picture to look natural.

Contrast is increased by developing longer and reduced by cutting the developing time. This is a helpful control that not only produces very printable negatives, but also may make it unnecessary to have on hand a wide range of different contrast papers. Most or all negatives can have a contrast range that is printable on a standard grade paper regardless of the subject or lighting contrast.

This principle of contrast control is based on the zone system developed by Ansel Adams, which involves exposing for a specific subject area and then developing the film so that other areas have specific density values, and fall into specific zones. Serious fine art black-and-white photographers are advised to study one or some of the books describing black-and-white zone system photography. Using this contrast control requires that all negatives on a roll of film be taken of subjects with similar contrast. The shorter medium format rolls with fewer images (usually 12) have in this respect an advantage over the longer 35 mm rolls with 24 or 36 exposures. Choose a film development time such that normal subjects will match the contrast of medium or grade 2 papers when printed on your own enlarger.

The Photographic Black-and-White Print

Quality black-and-white prints can only be obtained with a clean enlarger lens that is in top condition. Condenser enlargers yield somewhat higher contrast than the diffused light type. Condenser enlargers usually are brighter, so exposure times can be kept reasonably short. This type of enlarger is usually preferred for enlarging medium format negatives, but use the one that best suits the type of work you are doing. Whichever type you choose, make sure that the illumination is even over the entire field. You can test this by making a print without a negative in the enlarger. Focus the lens on the edges of the negative carrier and stop down to your usual printing aperture. Expose the paper so that it develops out to a middle gray. If the test print varies considerably in density over the printed area, the illumination is uneven.

Photographic Print

To maintain the maximum sharpness in the print, consider the quality of the enlarging lens, film flatness in the negative carrier, accurate focusing of the enlarging lens, and steadiness of the enlarger during

exposure. Pay special attention to the negative carrier. The larger film area of the negative has a greater tendency to buckle when exposed to heat in the enlarger. The negative may pop, no longer lie flat, or actually buckle and move while the exposure is being made. Using a glass carrier will prevent this, but remember that all glass surfaces must be kept clean.

Print quality is best when the printing paper is exposed so that the print density is just right when the paper has received the full development time. Considerable underdevelopment causes muddy and perhaps uneven image tones that may have an unpleasant, brownish image color. Over-development results in a lack of highlight detail, fog, or stain, or all three.

COLOR NEGATIVE AND COLOR TRANSPARENCY FILM

Color negative films are made in the daylight version only because the majority of amateur and professional images are made in daylight or with an electronic flash, both with the same color temperature. These films can be used under other light sources, tungsten or fluorescent lights, for instance, and without a filter on the lens. The necessary filtration can be employed when the print is being made. I recommend, however, whenever practical, using the necessary filter on the camera when the picture is taken. All images are then reproduced on the film as if you had taken them under the light for which the film was made, and the filter you use is the same as required for daylight color transparency film; thus, you eliminate many problems later in the darkroom.

Using a filter is especially suggested when no people are in the picture. Without flesh tones, the darkroom technician has no idea what the colors should be unless you include an 18 percent gray card or a color chart in at least one of the negatives. Even with people in the picture, correct colors cannot be assured because flesh tones vary from white to black. If nothing else, including a gray card in at least one of the negatives on a roll of film, eliminates future arguments with the laboratory.

Exposure and developing times cannot be varied when you use color negative film, because color negatives need the correct amount of exposure to produce sufficient shadow details.

Mounting Transparencies

Laboratories do not mount medium format slides. This is not really a disadvantage. Most professional slide work is presented to the client most effectively unmounted or mounted on a presentation board. If such slides are to be projected, glass mounting is highly recommended to eliminate popping in the projector.

Projection Quality

The true quality of a slide, 35 mm or medium format, often cannot be enjoyed on the screen because of the somewhat questionable quality of the projectors' condenser system and the projection lenses.

If you are interested in medium format slide projection, it is worth investigating the quality of a projector before purchasing it, and be prepared to spend quite a bit more than for a 35 mm machine. Buying a projector is a worthwhile investment because medium format slide projection is very effective. Once you have seen your slides presented in a high-quality projector, it is difficult ever to be satisfied with 35 mm slides.

ROLL FILM

120 Roll Film

All medium format cameras—regardless of what image size they produce—can accommodate 120 roll film. The 120 roll film comes in the widest variety of emulsions. With few exceptions, you can find just about every emulsion that is available in 35 mm. Because of its popularity, 120 film is also most readily available in stores—something travelers might want to keep in mind. At the same time, you must be aware that 120 roll film is not as readily available as 35 mm and is usually only sold in professional camera stores. This is especially true for transparency films. I highly recommend that you take enough film on your travels unless you go to large cities with a professional photographic population.

The 120 roll film has a paper backing from beginning to end. The main function of the paper years ago was for the proper film transport. That is why the paper backing has frame numbers printed on it. In the past, the user advanced the film by looking into a window while turning the film advance knob until the next number appeared in the window. In medium format cameras today, the film transport is automatic so the numbers are no longer necessary. As a matter of fact, the paper is no longer necessary, but it is still there.

220 Roll Film

Since modern medium format cameras no longer need the paper backing for spacing, film manufacturers started to spool 120 roll film with paper only at the beginning and end of the roll just to protect the film when loading and unloading in daylight. Leaving out the paper made it possible to put twice as much film on the same film spool, so a spool provides 24 instead of twelve 2 1/4 in. square images; 20 instead of 10 in the 6 × 7 cm format; and 30 or 32 instead of fifteen or sixteen 6 × 4.5 cm images. This new film became known as 220. Photographers who want to cut down on film changing, as in wedding, sports, and stage photography, appreciate the 220 roll film.

The 220 roll film is used mainly by professional photographers. As a result, only the most popular professional films are made in 220, and these films are available only in specialty camera stores that do professional business. If you like to work with different films, you might be better off staying with 120 film, and buying one or two additional magazines or inserts so you can pre-load additional rolls.

Depending on the camera, the use of 220 film instead of 120 may require an adjustment on the film insert, a different film insert, an adjustment on the camera, or a different film magazine. Manufacturers that supply a special 220 magazine feel it is important to adjust the springs and the pressure plate on the film insert to the particular thickness of each film to ensure best possible film flatness. Since perfect film flatness is of utmost importance for achieving the ultimate image quality in the medium format, it is worthwhile to consider this point when selecting a medium format camera system.

Long Roll Film

Longer rolls of 70 mm film can also be used on some medium format cameras with interchangeable film magazines. The 70 mm film is manufactured without perforations and with different types of perforations known as type I and type II. Perforated 70 mm film looks like 35 mm film, with perforations on both sides. Each camera or film magazine is made for a specific type of 70 mm film. Few film types are readily available in 70 mm form, so find out which film types are manufactured in a compatible 70 mm form.

Most 70 mm film magazines are made for use with cassettes, which are built and look like the 35 mm cassettes, except that they are larger. A cassette holds about 15 ft. of standard base film, which provides room for about seventy 2 1/4 in. square images.

The 70 mm cassettes can be loaded into the camera in daylight. Unlike 35 mm film, the 70 mm film moves from the full cassette into an empty cassette on the other side, so the film does not have to be rewound after it has been exposed.

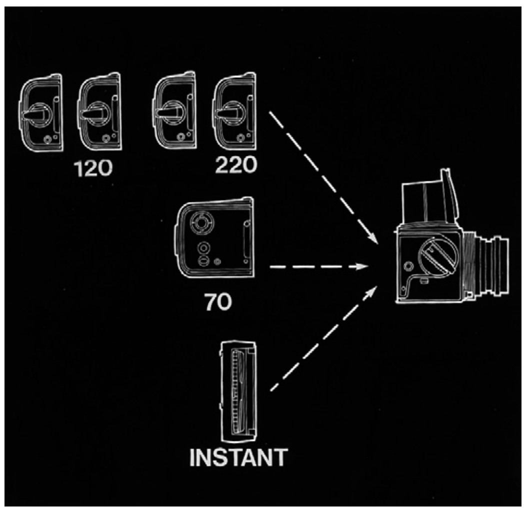
A few popular 70 mm films can be purchased in cassettes, ready to be loaded into the camera, but few 70 mm film types are readily available or even available on special order. Some are available only in longer lengths on spools for home loading into cassettes. The spooling must be done in complete darkness. It can be done by hand, but using a bulk film loader is more convenient.

Some cameras can also take magazines designed for 70 mm film on spools. The advantage is that the spools can hold more film and thus provide more exposures per roll. This advantage is not obtained without some drawbacks: the need for darkroom loading and unloading. Special emulsions for instrumentation, infrared, high-contrast work, copying, duplicating, and some microscope applications that are not available in 120 or 220 can be obtained in 70 mm, but a minimum order quantity is required.

Another consideration you should take into account before deciding on 70 mm film is that only a limited number of professional laboratories are equipped to process all or at least some of the 15 ft. or longer lengths of film without cutting them. But equipment is available for processing the film at home.

SHEET FILM

Magazines for sheet film used to be available for some medium format cameras, but, since they were seldom used, are difficult to find today. Such a magazine is designed and operates like those made for view cameras. The film is inserted in complete darkness into the sheetfilm holder, which is protected by the dark slide. Sheet film does not come in ready-made medium format sizes, so you must cut your own from larger sizes. This need for cutting the film to size is undoubtedly the reason these sheetfilm magazines have been used rarely and only for the use of special films not made in any other form such as orthochromatic black-and-white films or films for spectroscopy or photomicroscopy.



A major advantage for working in the medium format is the possibility of attaching a Polaroid instant film magazine at any time to a camera with interchangeable film magazines. Other film magazines can provide the option of using different film types or producing images in different formats.

INSTANT FILM

Instant films can be used on a number of medium format cameras. Camera manufacturers have introduced this possibility not to provide the medium format photographer with an instant snapshot camera, but so that serious amateur and professional photographers can see on a print the image actually recorded through the lens. Just as videotape allows an athlete to study his motions instantly or an audio tape allows a musician an instant test of sound quality and effectiveness, an instant

print is the most reliable assurance you can have that the camera is functioning properly, that the lens and camera settings are correct, that the flash is synchronized with the shutter, and that you are using the correct accessories. Instant film allows you to experiment without guessing and to make changes before the shooting starts. It eliminates guesswork, and saves on film and laboratory costs, and it also serves as an excellent teaching tool since it allows the student to see instantly the results of the teacher's approach. Professionals may want to use instant film to show the print to clients to determine whether the image is what was expected and to get instant approval.

Exposure Testing

Checking that exposure is correct is another, and often the most important, application for instant film. It is especially useful under unusual lighting situations or when you are combining different light sources. When you use Polaroid film for checking exposure, keep in mind the type of film you will be shooting. Transparency films must be exposed for the lighted areas, negative films for the shade. The lens settings are thus correct for slide film when the Polaroid test shot is properly exposed in the lighted areas. They are correct for negative film when the test shot has shadow detail.

Checking Light Ratios

In multiple flash setups, you can use instant film to check the effectiveness of the lighting, how and where shadows fall on the subject and the background, and to detect possible disturbing highlights. When you are combining light from different light sources, flash fill-in, for instance, Polaroid shots become still more valuable. An instant picture is a must for determining exposure as well as the effectiveness and evenness of the lighting when you are painting with light.

Effects of Shutter Speeds

There is no way you can see with your eyes or in the viewfinder how the shutter speed will affect or change the image of a moving subject. If you want to stop action, you can follow written guidelines, but there are no strict instructions for those instances when you want to record the moving subject with a blur to enhance the feeling of motion.

Make a test on instant picture film at one shutter speed. If the results are not satisfactory, shorten or lengthen the shutter speed to get more or less blur, and repeat the process until the instant picture shows exactly the desired results.

It is a good idea to make a test using instant film when you plan to move the camera to produce the blur; when you want to change the focal length of a zoom lens while the shutter is open to produce a zoom

effect; when you use vignettes, or other accessories in front of the lens, or when you are combining electronic flash with slow shutter speeds.

Instant film allows you to evaluate effects that cannot be seen on the focusing screen, such as the amount of blur produced by moving the camera in combination with a slow shutter speed.

As a Teaching Tool

Instant film material helps give others immediate visual proof of what you are shooting. This can be for the purpose of immediately showing photography students the result of a photographic approach under discussion, or for showing a model's performance in front of the camera. Instant film material allows an entire group to see things that normally can be seen by only one person, such as the view through a microscope.

Adjusting for Film Sensitivities

In the majority of cases, the negative or transparency film used for your final image will have a different exposure index than the instant film material used for the test. Thus, for correct exposure, something must be adjusted. The following adjustments are possible:

1. Change the shutter speed. Do this only when the shutter speed is not a deciding factor for creating the image. For blurred motion effects, the same shutter speeds must be used.

2. Change the aperture. I recommend this course of action when the shutter speed cannot be changed and/or when depth of field is not the deciding factor.
3. Use a neutral density filter either when making the test shots or when making the final shot. Depending which film has the higher sensitivity, using such filters allows you to make identical lens settings with any combination of films.

The amount of correction necessary is shown on the chart below, which is based on an instant film sensitivity of 100 ASA, 21 DIN, the most common film used for test shots.

EXPOSURE CORRECTIONS FOR FINAL FILM BASED ON 100 ASA POLAROID

Final Film				
ASA	*DIN*	*Change in Aperture*	*Multiply Shutter Speed*	*Use Neutral Density Filters*
50	18	Open 1 stop	2×	0.30 with instant film
64	19	Open 1/2 stop	1.5×	0.10 with instant film
100	21	None	1×	None
160	23	Close 1/2 stop	1×	0.10 with final film
200	24	Close 1 stop	1/2×	0.30 with final film
400	27	Close 2 stops	1/4×	0.60 with final film
800	30	Close 3 stops	1/8×	0.90 with final film

Shutter speeds are multiplied as follows:
Original shutter speed 1/125 second
2× = 1/125 × 2 = 2/125 = 1/60 second
1/2×: 1/125 × 1/2 = 1/250 second

Polaroid Film Magazine

The instant film image is obtained by attaching a Polaroid magazine to the camera; regular Polaroid film packs are used. It should be possible to switch magazines at any time, even in the middle of a roll of film. The sheet of instant film is larger than the image produced by the medium format camera so you waste some film, but the image and image size are the same as recorded on the roll film, and that is more important. Follow the instructions on the instant film pack regarding the use, storage, and developing of the film.

FILM LOADING

Roll Film Loading

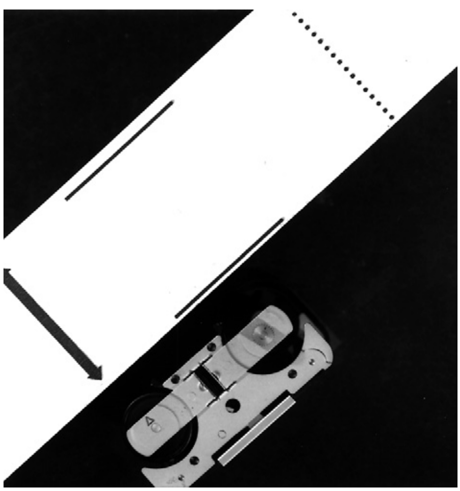
The 120 and 220 roll films are sold on spools. On the majority of medium format cameras, the film is loaded on a separate insert, which is inserted into the camera or a film magazine. The spool with the unexposed film goes on the feed reel, and the beginning of the film is at-

tached to an empty take-up spool. Roll film need not be rewound on the original spool as in 35 mm, so changing film is quite fast.

The film insert with the loaded film may go into a removable film magazine or directly into the camera body. The latter allows you to preload several inserts before going on a job. Changing film then involves only switching inserts. Inserts are less expensive than film magazines, but do not give you the opportunity to change film mid-roll or to attach a Polaroid magazine. The danger of fogging film is also greatly increased. If you want to take full advantage of the film changing possibility, you must consider loading the film into a completely interchangeable film magazine and forget about interchangeable film inserts.

On some cameras, the film moves from reel to reel in its natural curl, as rolled on the spool; on others, it moves in an inverse curl. It has been mentioned occasionally that inverse film movement reduces film flatness. Film flatness, however, is a matter of a properly designed pressure plate and magazine. I have never seen proof that the natural curl results in better film flatness and thus better sharpness, so I must assume that testimonials about natural curl are nothing more than an advertising strategy. However, regardless of how the film is spooled, the second image on a roll of film that has been left in the camera for some time may show a loss of flatness. If you plan to leave a film in the camera, advance the film just before you take the next image.

Roll film must be advanced to a certain point to ensure proper spacing. With 120 and 220 films, the thick arrow on the paper is set opposite an index engraved on the film insert before the insert goes into the camera or magazine. Some 220 films have a dotted line on the paper backing before the black arrow. Do not put the dotted line opposite the index. You will lose the first two frames. Move the film further to the black arrow.



On most film magazines and cameras, the arrow on the roll film must be set opposite an index on the roll film holder. Do not set the dotted line on some 220 films opposite the index.

Before a picture can be made, the paper leader must be moved through the camera. On older cameras, the film had to be wound to 1 by watching the paper through a window and turning the crank until 1 appeared in the window. On newer cameras and magazines, you simply turn the crank until it stops. The beginning of the actual film is now behind the aperture, and spacing between the images should be fairly even from here on. Spacing refers to the blank space between the frames. On some cameras designed for the 6 × 4.5 cm format, however, the space between frames changes, which is the reason you can obtain only 15 images instead of 16 on a roll of 120 film. On a well-designed camera or magazine, the space may vary somewhat, but it should never vary so much that the last image falls into the paper trailer, and there should always be sufficient space between images to cut the film.

While loading is simple, a few suggestions need to be made. Always completely remove the paper that holds the film tight on the spool; otherwise it may become loose and wedged in the film aperture and act like a mask in front of the film. Although roll film is designed to be loaded in daylight, do not load it in bright sunlight. Keep the film in the shade and tight on the spool during the entire process; otherwise light can fog the edges. Practice so you can load quickly without exposing the film to daylight longer than is necessary. After the last picture on a roll is taken, you must wind up the paper trailer before removing the film. The now empty feed spool becomes the take-up spool for the next roll of film.

Film Magazines

Cameras with interchangeable magazines are likely to be more expensive because they require a greater precision so every magazine fits perfectly on every camera and couples to the camera mechanism as if it were part of the camera itself. But the versatility of such cameras, allowing you to do things with one camera that otherwise require two or three cameras, may well be worth the additional cost.

Before removing a loaded film magazine from the camera, you must insert a dark slide so the film is not exposed to light. The purpose of a dark slide is the same as the dark slide in a sheetfilm holder of a view camera: to protect the film when the magazine is off the camera. It serves no purpose as long as the magazine is attached to the camera. Well, not quite. On most cameras you cannot depress the release until the dark slide is removed, at least partially. Thus the dark slide can be used to prevent accidental releasing.

Rotatable Film Magazines

Most medium format cameras made for rectangular pictures must be turned for verticals just like 35s. Another solution in the medium format is a rotatable film magazine; the film magazine, not the camera, is rotated for verticals. Such a design is a convenience, especially when

you are working on a tripod, but to accommodate this magazine, the camera body needs to be considerably larger—at least as wide as the long side of the negative in either direction—so what you gain in versatility you may lose in convenience.

OPERATING SIGNALS

Medium format cameras, especially those offering interchangeable film magazines, should have operating signals and controls to prevent mistakes, and to make it unnecessary for the photographer to do a lot of worrying while shooting. A frame counter that shows the number of exposed pictures is taken for granted. Most frame counters are coupled to the gears and work whether there is film in a camera or not. The camera or the film magazine should have a signal that shows whether there is film in the camera or magazine. The signal must work whether the magazine is on or off the camera, and to be reliable, the signal must be controlled by the film itself, not the mechanism in the magazine.

The camera or magazine should have a place where you can make a notation of the type of film you are using and its ASA rating. Furthermore, there should be a signal that indicates whether the film is advanced, and this signal must work with the magazine on or off the camera. The camera should also have some arrangement whereby the release cannot be depressed after you have exposed the last frame. This warning should preferably come right after you have shot the last frame, rather than when you try to depress the release again.

Unless you use the same film all the time, always indicate what film is in the camera or magazine.

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CHAPTER 5

Camera Types

Medium format cameras come in a wide variety of styles. Most are satisfactory for many different jobs, but some are better suited for certain applications than others. Your selection of a camera, therefore, must be based first on the subject matter or the photographs you plan to take. Then you can make a final choice of camera by investigating and determining how important the following features are for your application:

- shape of the camera;
- size, weight, and portability;
- type of viewing;
- degree of electronics and automation;
- component interchangeability;
- shutter;
- special camera features;
- availability of lenses and accessories; and
- quality and workmanship.

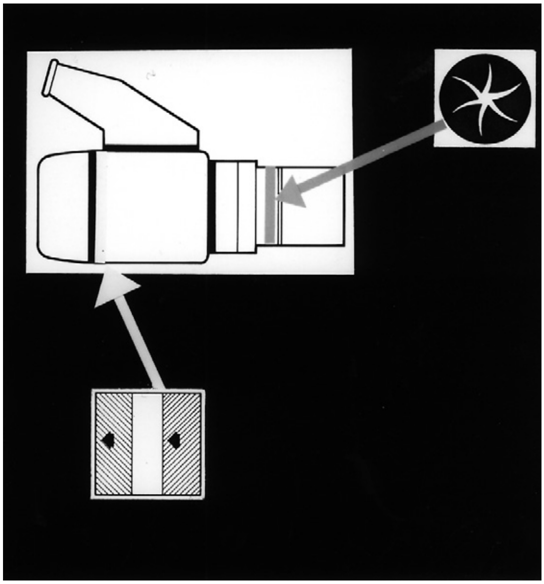
SINGLE LENS REFLEX CAMERAS

The single lens reflex (SLR) camera has become the most popular type in the medium format, replacing the twin lens reflex (TLR) that was the standard in the 1930s and 1940s. Now only a few TLR systems are still being made; whereas the number of SLR systems is constantly increasing.

Shutters and Mirrors

Medium format SLRs are available with a focal plane shutter in the camera or a leaf shutter in the lens. Furthermore, some focal plane shut-

ter cameras can be used with leaf shutter lenses—either just one or two special lenses or a complete range of lenses.

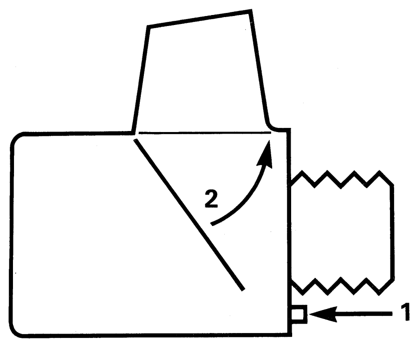


Some focal plane shutter models allow you to use shutter lenses. You can then decide which shutter to use for each shot and switch from one to the other. The focal plane shutter is likely to produce higher shutter speeds, while the lens shutter provides flash synchronizations at higher speeds.

In focal plane and lens shutter models, the reflex mirror swings out of the way so light can expose the film. Therefore the viewfinder image is blocked out until the mirror drops back in place after exposure. On some makes, the mirror returns instantly and automatically after the exposure has been made; on others, the mirror returns when you crank the shutter and advance the film.

Those who are used to the instant return mirror operation of the 35 mm may find the blackout of the viewfinder objectionable, at least at the beginning. Once you are used to it, you will see that it has no disadvantages. It is often said that the instant return mirror lets you see whether you have captured the expression; whereas the noninstant return type does not. This is not true. You cannot see the subject on the focusing screen the moment the exposure is made because the mirror is in the up position at that moment. On all SLRs, you can see the subject right before shooting; with the instant return mirror, you can also see the subject right afterwards. To see the subject the moment the exposure is made, you need a TLR or rangefinder camera or a sports or frame finder attached to the SLR camera.

Since the mirror on all SLRs (35 mm and medium format) must move out of the way before the film can be exposed, there is a slight delay between the time the release is depressed and the time the exposure is made. The delay is likely longer on cameras with built in metering systems and with automatic focusing but still short enough on most systems so there is nothing to worry about in most applications. But in action photography, the delay could result in your capturing on film a slightly different image of the action than what you see in the finder. The delay can be eliminated on most SLRs by locking up the mirror, thereby pre-releasing the camera.

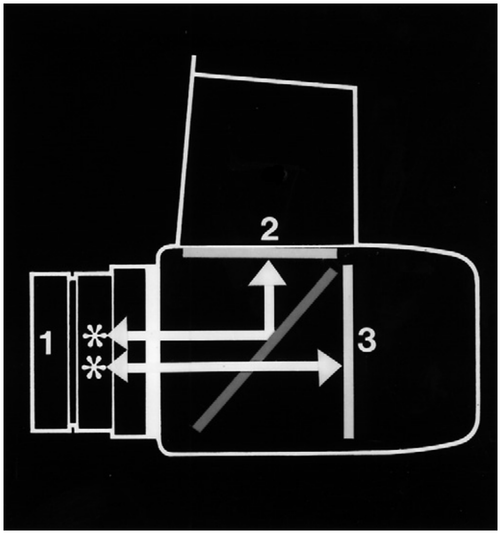


When the camera release (1) is depressed, the mirror (2) swings up, blacking out the view on the focusing screen. This happens on all SLR cameras. An instant return mirror swings back to the viewing position immediately after the exposure is made. A noninstant return mirror comes back when the film is advanced.

Viewing

In medium format SLRs, the picture is viewed, focused, and taken through one lens, and framing and focusing are accurate. There is no parallax error. With a waist-level finder, you view from the top, and the image on the focusing screen is right side up, but laterally reversed. With a prism finder the image is right side up and unreversed.

When you change lenses on an SLR, the viewfinder automatically shows the area covered by that lens. An even more valuable aspect of SLR viewing is that you can see how the image changes as the diaphragm is opened or closed. SLR viewing also simplifies close-up photography. You just focus until the image on the screen is sharp, regardless of what close-up lens or accessory you are using. Many SLR cameras also offer the possibility of measuring the light through the lens, combined with more or less exposure automation and some of the newer models also have automatic focusing.



In any SLR camera, the mirror must be precisely aligned so that the distances from lens (1) to image plane (3) and lens to focusing screen (2) are identical. It is suggested that you have the mirror alignment checked occasionally.

Size and Shape

The shape of the camera is an important consideration, especially for handheld location work. A medium format SLR can look like an oversized 35 mm camera, but most SLRs are more of the boxy type, with the largest dimension of the camera being the distance from the lens to the rear of the camera. The dimensions of the camera are dictated by the room the mirror needs to move freely up and down and by the design of the film magazine. Width and height are generally kept rather small—usually just a little more than the negative size. On the other hand, a camera with a rotatable film magazine needs to be considerably larger, because it allows you to photograph verticals or horizontals without turning the camera. The convenience of the rotatable magazine is an advantage, but the camera's bulkiness can be a drawback.

It takes a little time to get used to the boxiness of the medium format camera. It is held differently from the 35; the release is likely in a different position; and the viewing method may be different. But you can get used to these differences quickly and soon be holding a compact medium format camera as steady as a 35 mm, and shooting with it as fast as with a 35 mm SLR. Those who find holding a camera inconvenient should keep in mind that camera manufacturers make grips for their cameras. These typically mount to the tripod mounting screw on the camera's base and have a handle at one side of the camera or a grip at the bottom. The most convenient grips have a shutter button on the handle.

Convenience Features

Convenience features are important. If you do not have to worry too much about technicalities and camera operations while shooting, you are more likely to produce more exciting images. You can concentrate on the subject, lighting, and other creative aspects of photography. Among available convenience features are the signals that show whether film is in the camera and is advanced; the interlocks between components that let the release be depressed only when everything is done properly, and the positioning of the various knobs and scales. You should be able to read all important scales either in the viewfinder or the camera body with the camera in the normal shooting position, without having to turn and twist it in all directions.

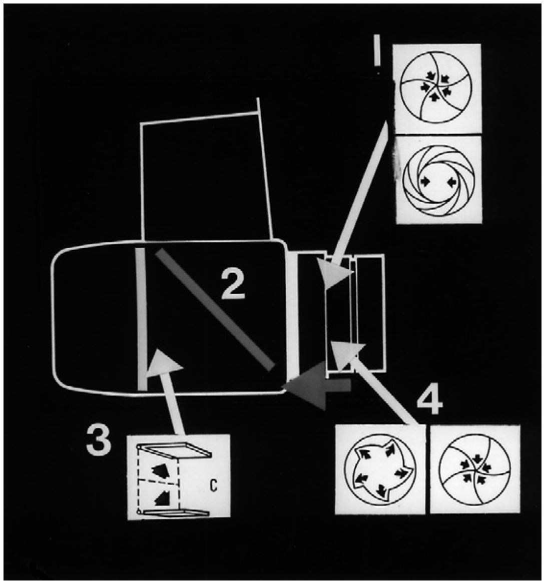
Lenses

Medium format SLRs also vary in the camera body-lens connection. Usually the lens is attached directly to the camera body, which results in a rugged camera that can take abuse, yet is small and mobile. The optical relationship between lens and film plane, so important for image sharpness, is likely to be accurate in this type of setup. Some cameras have a bellows between camera body and lens mounting plate, which allows continuous focusing from infinity down to close distances, somewhat like with a view camera. These cameras allow you to shoot some close-ups without buying additional accessories. The lens board might even tilt to increase the range of sharpness. This design also eliminates the need for focusing mounts in lenses, reducing the lens cost, but ruggedness and precision in the body/lens alignment suffers.

Camera Design

SLR cameras in any format are complex. They contain a mirror that must move in a precise path up and down, and must do so quickly and without causing too much camera movement. The mirror must maintain accurate focusing, which is possible only if the mirror moves back to exactly the same position after each exposure. Its movement must be synchronized to the shutter in the lens and/or camera. If lenses are interchangeable, the diaphragm and shutter of every lens must synchronize with the rest of the operation. If the film magazines are also removable, precision is necessary so that each magazine fits on every camera as if it were part of the camera.

The SLR is the most expensive type of medium format camera, but it is also the most versatile. Versatility is probably what you want and expect from a medium format camera system, a system that provides the desired results in the most convenient fashion regardless of what you may have to or want to photograph.



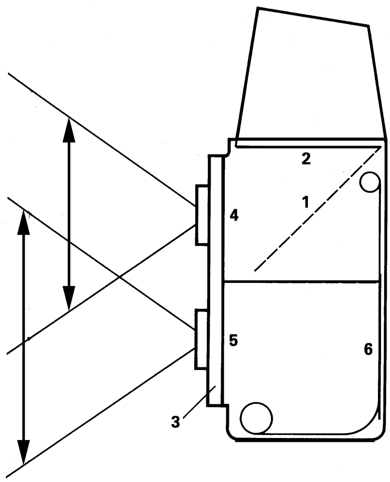
In an SLR camera with a lens shutter, the lens operation must be coordinated with the mirror and rear curtain. When the release is depressed, the lens shutter closes down, and the normally wide-open aperture closes down to the preset aperture (1). At the same time, the mirror lifts up (2). With the lens shutter fully closed, the rear curtain opens (3). Then the lens shutter opens and closes for the set time to make the exposure (4). The purpose of the rear curtain is to protect the film from light before and after the exposure is made. In a focal plane shutter camera, the shutter curtain serves this purpose.

TWIN LENS REFLEX CAMERAS

Twin lens reflex (TLR) refers to the camera's optical system. In a TLR, two lenses of identical focal length are mounted one above the other, with centers 40 to 50 mm apart. The top lens is for viewing, and the bottom lens is for taking the picture; the lenses are called, respectively, the viewing lens and the taking lens.

In contrast to the single lens reflex (SLR) design, the TLR is simple. The mirror is installed permanently and never moves. There is no rear curtain, so the lens shutter need not be synchronized to any other operations. The simplicity means the camera has few problems; little can go wrong during normal operation. And it has another benefit: very quiet operation. The only audible noise when the release is pressed is the opening and closing of the lens shutter blades. On an SLR camera with a lens shutter, the sound can be brought down to the TLR level by pre-releasing the camera, which lifts up the mirror and opens the rear curtain, the two operations responsible for the sound. When the release is depressed later, only the lens shutter opens and closes, just as on the TLR. TLRs also have little or no vibration when used on a tripod or camera stand.

Although TLRs are simple in design and operation, they are not snapshooter's cameras. For many years they were the most professional medium format cameras available, and they are still used today in professional work. Experienced photographers have learned to live with the limitations and make the best of what the camera offers. The limitations do not mean inferior image quality. TLR cameras have always been equipped with top-quality lenses.



In a TLR camera, the viewing box on top contains a fixed mirror (1) and focusing screen (2) and is for viewing and focusing only. The picture is made on the film plane (6) in the box below. The two lenses of equal focal length are mounted on a common plate (3) that moves forward and backward when you focus. The viewing lens (4) sees a different area than does the taking lens (5) at closer distances so you must compensate for this parallax. Interchangeable lens models are also available with the removable lenses mounted on a common plate.

Viewing on Twin Lens Reflexes (TLRs)

On a TLR, only the taking lens needs to be of high quality. The viewing lens needs to be just good enough to provide a good image for viewing and focusing. The image formed by the viewing lens is reflected by a reflex mirror and intercepted by the focusing screen. When the focusing knob is turned, both lenses move together. The typical viewing lens cannot be adjusted to visually check the image at the shooting aperture. The image on the screen is always as seen by the lens wide open, perhaps even wider than the taking lens, because some viewing lenses have larger apertures to produce a brighter image. Therefore, you cannot see how the image changes by opening or closing the aperture, and this is the camera's greatest weakness for serious photographers.

There is a benefit to the fixed mirror, on the other hand. When you trip the leaf shutter, the viewing image is not blacked out. The leaf shut-

ter operates only in the taking lens. So you can see the subject at the moment of exposure, not just before and just after. On some TLRs, focusing screens and viewfinders are interchangeable, and the choice of finder may include a type with a built-in metering system.

Parallax

The image you see through a TLR is not exactly the same image captured on the film, because the centers of the two lenses are separated vertically, giving them slightly different fields of view. The effect is called parallax error. It is not a serious problem except with close-up pictures.

The TLR's weakness is in versatility. It is a great tool for ordinary photography at longer distances with the range of accessories limited to those designed for photographing long distance shots.

Camera Shape

The shape of all TLR cameras is identical. With viewing and taking chambers arranged vertically, the longest camera dimension is from bottom to top. This camera is made for the square format, mainly because it would be impractical to turn the camera sideways for verticals. It is not made for interchangeable film magazines, but usually offers the possibility of using 120 and 220 roll film. Although the operating cycle is much simpler than the SLR's, shooting speed is about the same. Both require turning a knob or crank to advance the film, which usually recocks the shutter.

RANGEFINDER CAMERAS

Rangefinder cameras have an optical viewfinder that is as bright and clear as the view with the naked eye as there is no focusing screen between the subject and the viewer. Since the camera does not need a mirror, the camera can be made to fold up, with the lens collapsing into the camera body. The result is an extremely compact camera, the smallest and lightest medium format type. If made for the smaller 4.5 cm × 6 cm format, it can be truly pocket size. Some cameras have built-in meters. In shape, all look like oversized 35s, with the viewfinder or viewfinder-rangefinder combination on top. Some manufacturers offer two models with the same or similar features, but with lenses of different focal lengths. All rangefinder models have shutters in the lens, usually up to 1/500 second, synchronized for flash at all speeds. The choice of format ranges from 6 × 4.5 cm to 6 × 6 cm, 6 × 7 cm, and even 6 × 9 cm. Rangefinder cameras do not have film magazine interchangeability. But most cameras provide the choice of 120 or 220 roll film.

The major variation in design among basic models is in the lens-camera connection. On some, the lens is fixed to the camera body; on others, the folding type lens collapses into the camera. The latter are not

only more compact, but also provide complete lens protection while you are carrying the camera around. Although rangefinder cameras do not have the range of features and possibilities one might associate with medium format photography, they are beautiful and modern looking. Some include a built-in light measuring system.

Rangefinder cameras are not intended for sophisticated work, but have all the features that the press photographer and average amateur needs for family and travel shooting. Focusing with a full field rangefinder is easy and most accurate, assuming that everything is aligned properly. A rangefinder is a fairly delicate instrument, so its accuracy should be checked once in a while by focusing on a subject at a known distance, infinity or perhaps 10 ft., and checking that the distance on the focused lens corresponds with your actual distance from the subject.

Since you don't view the image through the lens, the finder can be made to show a field larger than that covered by the lens. The area covered on the film is then indicated by lines within the finder. This wider field can help in composing. You can see subjects that might be coming into the field of view before they actually do. A rangefinder camera also lets you see the subject the moment the exposure is made.

WIDE ANGLE CAMERAS

Some of the viewfinder or viewfinder-rangefinder cameras are equipped with a wide angle lens ranging in focal length from 38 to 65 mm. These cameras are made so the medium format photographer can benefit from using the type of wide angle lens typically found only on view cameras. Such wide angle lenses are not the retrofocus types found on SLR cameras. They are optically true wide angle designs offering the best possible wide angle quality at long or short distances. Architecture and aerial photography are among the more serious applications for such a camera. A 38 mm lens has a diagonal angle of view of 90 degrees on the 2 1/4 in. square format. Since these short focal length lenses have great depth of field, focusing by estimating the distance is usually satisfactory. A spirit level, built in or as an accessory, however, can be a great help to assure that the camera is level to record verticals, straight and parallel.

The Hasselblad 903 SWC (Superwide) is a camera that also offers magazine interchangeability with the possibility of using 120 and 220 roll film, 70 mm sheet film, and Polaroid film and the ability to focus on your subject with the aid of a focusing screen accessory.

PANORAMIC CAMERAS

The range of medium format cameras is increased by cameras designed for producing a panoramic image with a long image dimension from 12 to 17 cm, but still using the standard roll film.

The long format is appropriate for wraparound book covers, calendars, and annual reports, or just for presenting something different.

The lenses on panoramic cameras are actually view camera lenses and are the most expensive part of the cameras. To cover that long format with superb corner-to-corner quality, the lens must be made to cover either the 4 × 5 in. or 5 × 7 in. view camera format. The panoramic negatives require an enlarger capable of printing from 4 × 5 or 5 × 7 in. negatives.

The Hasselblad XPan is also a panoramic camera with lenses designed to cover the 6 × 4.5 cm medium format, but uses 35 mm film.

The features and operation of panoramic cameras are very much like those of the viewfinder-rangefinder cameras. Panoramic cameras can be handheld or set on a tripod. A built-in spirit level is helpful because a level camera is important for effective panoramas.

PRESS CAMERAS

Press-type cameras, the folding type with bellows or the models with the lens mounted on the camera body, are another version of medium format viewfinder-rangefinder types. They have a large viewfinder, a permanently attached camera grip, and leaf shutters in the lenses, which can be replaced by lenses with focal lengths from wide angle to telephoto. Shutter cocking is a separate operation, not coupled to film advance. I consider these cameras outdated, especially for news work.

CAMERAS WITH SWING AND TILT CONTROL

There is at least one medium format camera with swing and tilt controls like a studio camera, but using the more economical and practical roll film. Other special medium format camera types allow tilting or shifting one plane, usually the image plane. By tilting the image plane for an increased sharpness range, the lenses do not need a larger covering power. You may be able to use the standard camera lenses at least for tilting. The Hasselblad Flexbody meets these specifications. Shifting, regardless of whether it is done with the lens or image plane, requires lenses with a larger covering power.

STUDIO CAMERAS

School photographers use motor-driven long roll cameras made specifically for this staged, large production photography. The cameras use either 70 mm or 46 mm film, and the cameras are designed to print information on the negative for identification purposes.

MOTOR DRIVES

Medium format cameras are available with motor-driven film transport. This feature can be built into the camera, or you might be able to attach an accessory motor winder to the camera in place of the manual winding crank. If this motor drive accessory is also designed as a carrying handle, it is usually referred to as a power grip and can make carrying the camera and operating it handheld much more convenient.

The main function of a motor is to advance the film automatically after each picture. A motor that does nothing more than that is an autowinder. In a more sophisticated version, the autowinder might also wind the film to frame 1 and wind up the paper trailer after the last frame has been shot. A motor may also provide automatic exposure bracketing. A true motor drive can provide additional helpful possibilities, such as remote and multiple camera operation.

Motor-driven film advance is a convenience—it can increase the speed of shooting. Motor drives are usually very reliable; the danger of something going wrong with the motor is not any greater than with any other part of the camera mechanism. The motor drives perform the camera operations in the proper sequence at the proper time.

Motor drives have negative aspects as well. They add weight and bulk to your camera, and the motor operation is dependent on batteries. You need to be sure that your batteries are in good condition, and carrying spare batteries is highly recommended. If the motor drive on your camera is an accessory, you can avoid both problems by removing the motor and operating the camera manually. Some cameras with built-in motors also allow you to operate the camera manually in an emergency, perhaps in a limited mode.

One specification you must check when investigating motor-driven cameras is the number of images you can obtain per battery charge. This depends partially on the type of batteries. Most cameras use either rechargeable nickel cadmium types, or standard AA or rechargeable AA cells. Nicads work well and can be recharged hundreds of times, but they must be treated properly.

They should never be overcharged, and they must be discharged completely once in a while. If you use them only partially and bring them up to par with a partial charge, you create a memory and the battery no longer has full capacity. Discharging the batteries completely also gives you the advantage of knowing how long to charge. But there is no practical way of determining how much charge is left in a partially used Nicad.

Standard AA cells seem to be preferred by pros. They are inexpensive, can be purchased anywhere in the world, and the battery capacity can be determined with a battery checker that may even be built into the camera's motor drive.

Sequence Operation

Shooting sequences of images at a fast rate can be valuable in action, sports, and scientific studies. If this is your main reason for considering a motor drive, however, first determine what rate of speed you'll need in your application and then read camera specification sheets. Most medium format cameras do not provide the speed of several frames per second that is offered by 35s. Most medium format cameras operate more in the neighborhood of one frame per second, which is often satisfactory, practically perfect for photographing models in fashion photography.

Shooting Readiness

The motorized camera is always ready for shooting. You can take a second picture practically instantly after the first. You can shoot that second or third image without even having to remove your eye from the finder, whether you work handheld or from a tripod.

This is the major benefit for most photographers and the reason motor driven cameras are usually used in fashion work and when photographing children. You can constantly watch the subject, never losing contact.

When photographing people, especially children, the best expression often appears just after the picture was snapped, perhaps as a sign of relief. This expression lasts for a moment, never long enough for you to capture it with manual film advance, but long enough for you to give a second push on the release of the motor-driven camera.

Simplicity of Operation

Camera operation, which is reduced to pressing the release on a motor-driven camera, can be done with one hand. This ease of use comes in handy when your other hand is holding onto something, holding a flash or other accessory, directing people, or shading the lens or your eyes.

Automatic electric film advance is smooth, and there is little danger that a mounted camera will move out of position between shots, an advantage especially in close-up photography and copying documents.

Remote Operation

Remote camera operation is useful or necessary when it is dangerous or impossible to be near the camera. Remote operation is frequently used in aerial applications, with the camera built into the aircraft. Remote operation, however, is not limited to such special applications; it can also be helpful in portrait, fashion, pet, and child photography.

To be successful in photographing people, you need to be able to direct them, whether they are professional models or nonprofessionals. Although this can be done from behind the camera, it is often easier when you are close to the subject. With a remote operated camera, you can be close to the people, watch their expressions, direct, play with a child, and snap the shutter when everything is right. You need return to the camera only to change film and lens settings.

A motor-driven camera can be set up to photograph a wedding ceremony from a location where a photographer is not allowed or from where the camera can provide a different view from the one the photographer has standing in the aisle. One photographer can actually operate two cameras: one handheld and the other set on a tripod somewhere else.

Remote operation can be done in many ways. Cables provide a simple, but frequently inconvenient method. Wireless remote operation is available today for various motor driven medium format cameras and

should definitely be considered as long as you can be within the distance range of the wireless remote.

The triggering source can be a radio, sound, light, or infrared signal. The signal produced by a transmitter is picked up by a receiver on or close to the camera.

Multiple Camera Operation

Some wireless remote controls are designed to operate multiple cameras. Multiple camera operation (taking simultaneous pictures at exactly the same moment with more than one camera) has interesting possibilities and important applications in many fields of photography. It usually involves recording unique events or happenings where the photographer has only one opportunity to capture a particular image and no time to change film, lenses, or camera angles. It could be the finish of a horse race, the takeoff on a ski jump, or almost any other action to be photographed from different distances, camera angles, or with different focal length lenses. Multiple camera operation also gives you the possibility to record the same happening at the same moment on two different types of film.

Recording simultaneous images on different film emulsions is also known as multi-spectral photography. This technique is used mainly for investigating pollution problems or diseases in fields and forests. The images captured on different films, including infrared, and taken through different color filters can show the scientist the source of the problem, which may not be apparent in one image.

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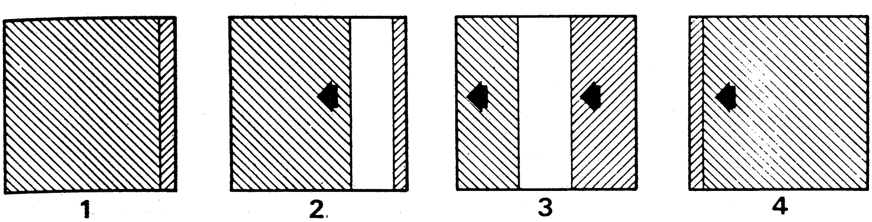
CHAPTER 6

Shutters

FOCAL PLANE SHUTTERS

The focal plane shutter consists of two curtains moving vertically or horizontally in front of the image plane. In medium format cameras with interchangeable magazines, the focal plane curtain is at the rear of the camera body and is fully exposed when the film magazine is removed from the camera. To avoid curtain damage, the camera should be stored with the magazine on the camera, and the magazine should be changed with care. Most curtains are damaged when a corner of the magazine accidentally hits the curtain.



With a focal plane shutter, the film is exposed progressively as the shutter curtain moves across the image area. When the release is depressed, the first curtain starts to move. The second curtain is delayed based on the set shutter speed. At high shutter speeds, the full image area is never exposed at the same time, thus flash synchronization is impossible.

Shutter Design

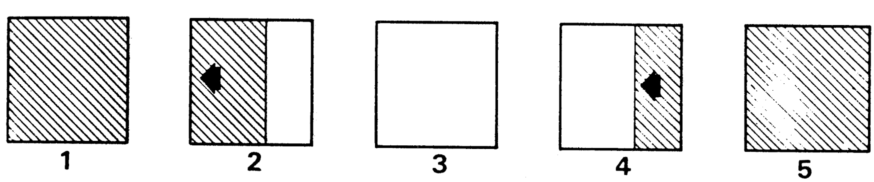
A modern focal plane shutter consists of two curtains. Between pictures, the curtains cover the film completely so that the lens can be

changed at any time without fogging the film. At high shutter speeds both curtains start moving the moment the release is depressed. When the shutter speed is set slower, only the first curtain moves when the release is depressed; the second curtain follows later. The delay time is determined by the shutter speed. On many medium format focal plane shutter cameras, the shutter speed is controlled electronically at least up to a certain length, perhaps about 10 seconds. The actual movement of the curtain is mechanical, but compared to a leaf shutter in lenses, fewer mechanical components are involved, especially parts that require lubrication. Longer exposure times can be obtained by manually keeping the shutter open for the desired number of seconds.

Flash Synchronization

Since a focal plane shutter scans the image area, different areas of the film are exposed to light at different times. This means that when flash is used, the flash must go off when the shutter is open over the entire film area; otherwise only part of the film area will be exposed by the flash. At high shutter speeds, the second curtain starts to move covering up part of the film area before the first curtain has disappeared completely. Consequently, you should make flash pictures only at slower shutter speeds. Over the years, the flash synchronization range has been increased dramatically for 35 mm focal plane shutter cameras, so that they can be synchronized with flash up to 1/250 second—perhaps even shorter by the time this book comes on the market.

On medium format cameras, such a wide flash synchronization range is not possible because the curtains have to travel across an area that is about twice as wide as that on 35 mm cameras. Some medium format cameras allow a top speed of only 1/30 second, a serious limitation in such applications as sports and flash fill work. Other cameras allow flash sync up to shorter times, at present up to 1/125 second, a good improvement over 1/30 second. Keep the flash synchronization limit in mind if electronic flash is used for much of your work. The lim-



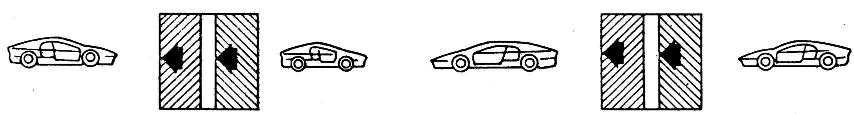
The flash must fire at (3) when the first curtain has fully exposed the film area but before the second curtain starts to move. This occurs only up to a certain shutter speed. At higher speeds, the second curtain starts to move before the first curtain has fully exposed the film area. Part of the picture is blank, as in (2) and (4).

ited sync range explains why some medium format camera manufacturers offer one or two shutter lenses for use on their focal plane shutter cameras.

If you accidentally set your camera's shutter speed too high, you may not discover the mistake until the film is processed. To avoid this, some cameras have a built in flash firing control so that the flash will not fire when the shutter speed is set too high, or the shutter speed will set itself automatically to a synchronized speed, eliminating or reducing the danger of a costly mistake.

Distortion

Focal plane shutters, especially those that move horizontally, produce another undesirable effect when you photograph moving subjects. By the time the shutter curtain has moved across the film area, a moving subject has also moved. As a result, the image you record of the moving subject may appear physically longer than it really is when the image crosses the film in the same direction as the curtain, or physically shorter when it moves in the opposite direction. In either case, this irregularity is referred to and recognized on the film as a form of distortion. A moving round wheel is recorded as an ellipsis. There are few cases, however, in which this distortion is objectionable.

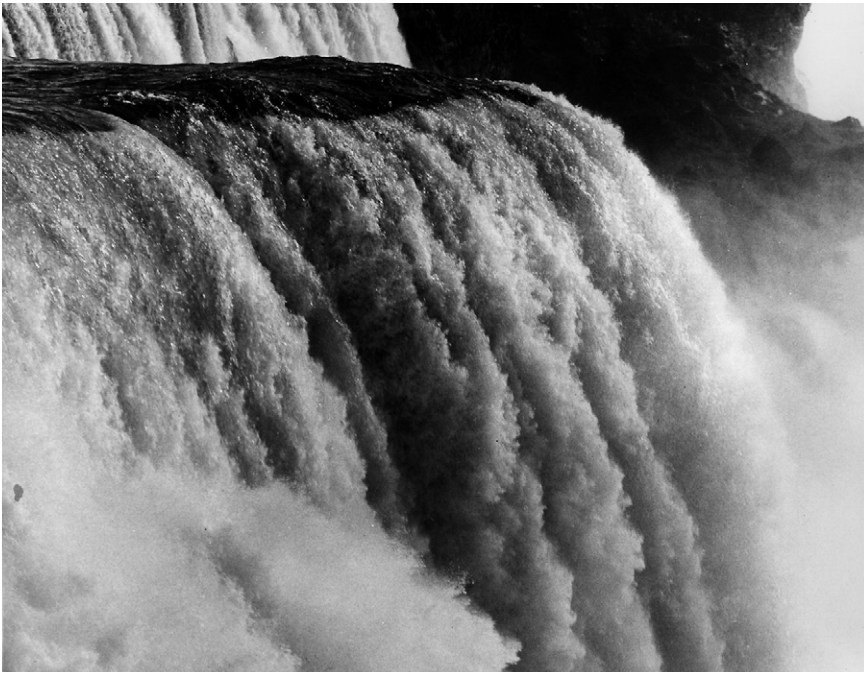


Focal plane shutters can distort images of moving subjects elongating a subject that moves in the same direction as the shutter curtains, shortening one that moves in the opposite direction.

Shutter Speed

Because the focal plane shutter is completely separated from the lens aperture, the effective shutter speed is the same with all lenses, at all aperture settings. Focal plane shutters tend to be noisier because the curtains move at a rapid speed over a large area. Since the shutter curtains move horizontally or vertically, they are also likely to present a greater danger for camera movement. Lens shutters are quieter and operate more smoothly.

Focal plane shutters can be made to produce accurate exposure times at higher speeds than lens shutters—up to 1/4000 second on medium format cameras, perhaps even shorter on future cameras.



Focal plane shutters go to higher speeds, as high as 1/2000 second or shorter in medium format cameras, allowing you to freeze faster moving subjects.

Lens Variety and Design

The focal plane shutter camera can be used with just about any type of lens and also in applications where lenses are not needed such as photographing through a microscope or telescope. Focal plane shutters eliminate the need for each lens to have its own shutter, thus perhaps reducing the cost of the lens. More important, putting the shutter in the camera instead of in the lens increases the possibilities in lens design. A shutter in a lens limits lens design and also makes it more difficult, or impossible, to increase the maximum aperture and the minimum focusing distance of a lens.

LENS SHUTTERS

In a leaf shutter built into a lens, shutter blades open and close at the set speed, exposing the entire film area at the same time and for the same length of time. With lens shutters, distortion of moving subjects

does not occur. A lens shutter is likely adding to the cost of the lens. On the other hand, if you have a problem with a shutter in one lens, you can continue to photograph by switching to another lens.

A lens shutter also complicates the design of an SLR camera because a curtain of some kind must be built into such a camera to prevent light coming through the lens or finder from reaching the film. The lens shutter and rear curtain operations must be synchronized so that the lens shutter is fully closed before the rear curtain starts to open, and the rear curtain must be fully open before the lens shutter opens again to make the exposure. These operations are done fully automatically and can be done with a very short delay of perhaps 1/25 second in a modern camera.

OPERATING THE CAMERAS

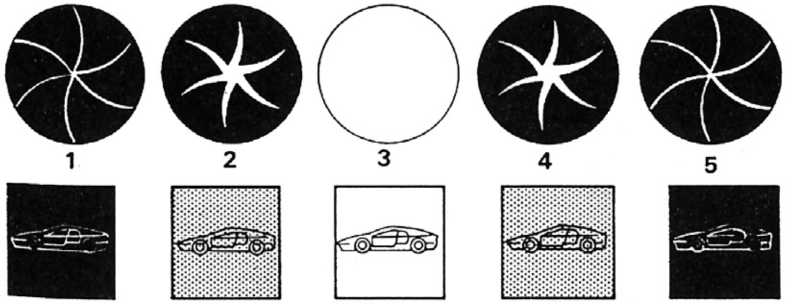
Pre-releasing Cameras

Lens shutters function smoothly and quietly. In an SLR camera, however, there can be additional noise and vibration from the mirror lifting up and the opening and closing of the protective rear curtain. To suppress the noise, which is especially valuable when photographing in churches, synagogues, and museums, pre-release the camera before shooting. This means the mirror is lifted up, the lens shutter is closed, the aperture is pre-set, and the rear curtain is opened before the exposure is made. The only sound that is heard when taking the picture is the opening and closing of the lens shutter, which is, for all practical purposes, not heard at all.

Pre-releasing is recommended when you are using any SLR camera, focal plane, or lens shutter type on a tripod or stand, especially at slower shutter speeds and with longer focal length lenses. Pre-releasing helps in reducing the danger of camera motion especially on a lens shutter camera. It can also reduce camera motion on a focal plane shutter camera, but to a limited degree since pre-releasing does not eliminate motions that might be created by the focal plane curtain.

Flash Synchronization

Lens shutters can be used with flash at every shutter speed up to 1/500 second. This must be one of your main considerations when choosing a camera type for flash work such as for wedding photography. At least one focal plane shutter medium format camera can also be used with an entire line of shutter lenses, from fish-eye to long telephotos. Equipping such a camera with a shutter lens means having a camera with two shutters, one in the camera and one in the lens, and you can use whichever is best for each application.



With a lens shutter, the image becomes bright and then darkens again, but the entire film area is exposed completely during the entire cycle so there is no image distortion and flash can be used at all shutter speeds.

Lens shutters synchronize with electronic flash at all shutter speeds, which can be extremely helpful in flash fill work on sunny days outdoors.

Electronic and Mechanical Shutters

Lens shutters can be timed mechanically or electronically. Electronic control is claimed to be more accurate, especially at cold temperatures, but you have to rely on battery operation. Batteries can have their own problems in cold climates. Since the movement of shutter curtains or

blades is mechanical in all shutters, mechanical shutters in lenses have proven to be practically as accurate as those controlled electronically.

Mechanical lens shutters, however, must be cleaned and lubricated frequently to remain accurate and reliable, especially in cold weather. This maintenance is necessary mainly because lenses cannot be sealed completely. As a result, dust will make its way into the lens. While lubricants work differently at different temperatures, manufacturers of quality lenses today use lubricants that work properly down to low temperatures, eliminating the need for "winterizing" except for special cases.

Shutter Operation

Camera operation is pretty much the same on focal plane and lens shutter models. After the exposure is made, moving a lever or turning a crank recocks the shutter and advances the film. On some older cameras, shutter cocking and film advance were two separate operations, a rather old-fashioned approach that limits the speed of shooting.

It is worthwhile to check out the position of the shutter speed and aperture indication on the camera lens combination. When both indicators are next to each other, making and checking the settings is more convenient and your speed of shooting increases.

Focal plane and lens shutters may be connected to a self-timer. Self-timers trip the shutter automatically after a delay of a few seconds, allowing the photographer to be in the picture.

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CHAPTER 7

Image Quality

Image quality depends on many factors such as precision in the camera design, especially the lens/body and lens/film magazine connection, accuracy in the mirror and focusing screen alignment, film flatness, and the quality of the lenses. Image quality is also determined by the camera/lens operation, accuracy in focusing, exposure, and camera steadiness.

The superb sharpness and definition of today's film requires that we be more critical about everything that affects sharpness if we want to be assured of capturing images of the utmost quality on these films. We must be more precise in focusing and exposure; we must be more restrictive in the use of depth of field, pay more attention to the precision and workmanship in the camera, lens, and film magazine, be more critical when focusing and more careful about camera steadiness. Sharpness can be ensured only if the camera is absolutely motionless from the moment the shutter opens until it closes.

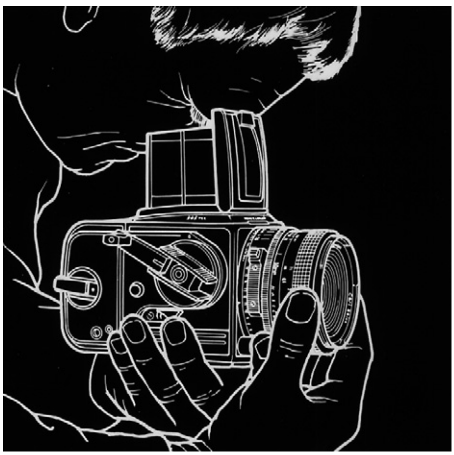
HANDHELD OR TRIPOD

A fairly common opinion is that medium format cameras are made for tripod use. Some cameras are so heavy and large that they cannot be carried too far or for too long without becoming a burden. But most medium format cameras are light enough to be carried suspended around your neck, on your shoulder, or held in your hand without becoming uncomfortable, and are ideally suited for handheld operation. Properly held and operated, they can be as steady as handheld 35s.

Handheld camera operation is particularly suggested when you want to photograph from different heights and angles. A tripod does not preclude this approach, but does restrict you. It is time-consuming to set

up a tripod and change tripod height, even more time-consuming to move the tripod around while you are investigating different camera angles. A tripod often makes it impossible to go down to low angles. As a result, tripod photographers tend to shoot everything from eye level, the most convenient camera height. They never investigate different possibilities.

If you want or have to use a tripod, I suggest that you first investigate all the possible angles, distances, and use of different lenses before placing the camera on the tripod. Move around the subject with a handheld camera; view the scene from every angle, from different distances, and through different lenses; go down on the ground and view the scene from below; go as high as possible and look down. Don't set up the tripod until you have thoroughly exhausted all possibilities and found the most effective camera position.

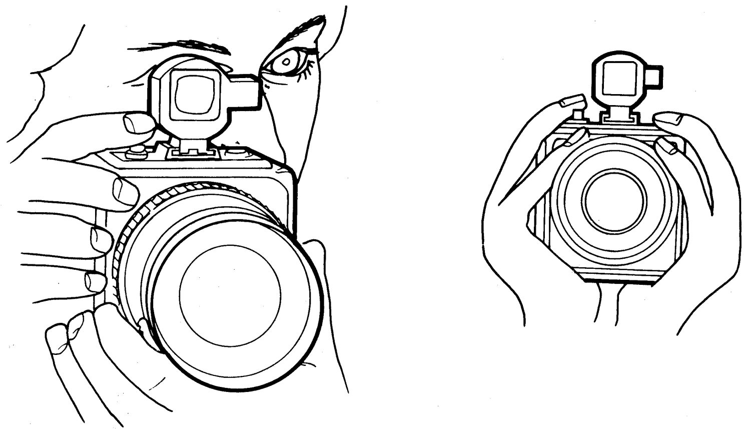


Besides camera steadiness, it is also worthwhile to investigate the convenience of operating all the camera and lens controls, especially when the camera is used for handheld photography.

HANDHELD PHOTOGRAPHY

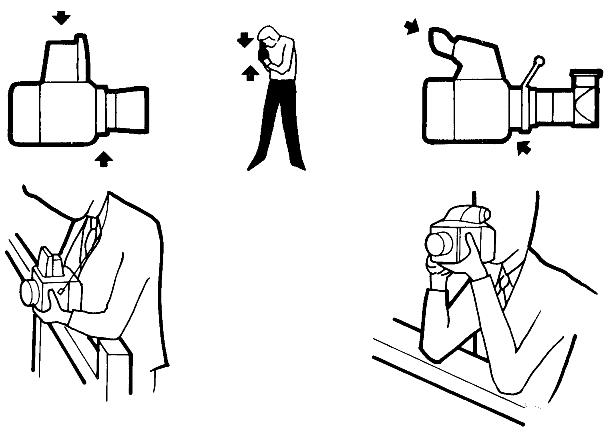
Most medium format cameras can be operated handheld. A grip or handle does not necessarily improve camera steadiness, but may make holding the camera more convenient and certainly allow more convenient camera carrying. Grips and handles are available for many cameras. It is worthwhile investigating and actually trying out these accessories under specific shooting conditions. Many photographers would never use a medium format camera without a grip, and others feel more comfortable with their hands on the camera body. Whether or not to use a grip is a personal decision.

Manufacturers usually suggest a specific way of holding the camera. This works fine in most cases and with normal lenses. You may find, however, that using a different grip works better for you. For example, you may find that placing one hand around the lens barrel rather than both hands on the body works better with longer telephotos.



Cameras can be held in many ways. With some cameras, both hands surrounding the camera body (right) works well. Sometimes, it is better to use one hand to steady the lens (left).

Try different methods of holding the camera until you find the way that suits you. However you hold the camera, you need a firm foundation. Start by standing with your feet apart. Press your elbows into your body for additional bracing. To hold something steady, you need two forces opposing each other—one pushing one way and the other pushing the opposite way. The direction of the action depends on the type of viewfinder. With a waist-level finder, pull the camera up with your arms and hands, and push it down with your face. With a 90° or 45° viewfinder, pull the camera towards your face and use your forehead to push in the opposite direction.



Best camera steadiness is obtained when the eye and forehead presses the camera in one direction and the hands press it in the opposite direction. With the waist- level finder, the hands press the camera up and the eye pushes it down. With prism finders, the hands push the camera toward the face, and the eye pushes it forward. Whenever possible, improve camera steadiness by using natural supports for your arms or body.

When shutter speeds become too long for steady handheld photography, some kind of support is necessary. Before rushing for a mechanical camera support, investigate other methods of steadying the camera, such as by leaning your body, head, or camera against a wall, post, or tree or resting the camera on your elbows on a suitable surface. Rather than placing the camera directly on the surface, try using a beanbag, which shapes itself to the contours of the surface and the camera, and minimizes camera movement. For low camera angles, lie on the ground and use your elbows as a support.

Handheld photography complicates communication with your subject. A tripod mounted camera leaves you free to direct the people you are photographing because your eye need not be glued to the viewfinder.

CAMERA USE AND OPERATION ON A TRIPOD

Steadiness is the main reason, but not the only reason, for using a tripod. A mounted camera also leaves you free to move around and communicate more directly with your subjects. This is especially true with a motor-driven camera. Once you have lined up a shot, you no longer need to look on the focusing screen; you can look directly at the people and communicate with them. With a handheld camera in front of your face, you lose contact with your subject; you talk into the camera, not to your subject.

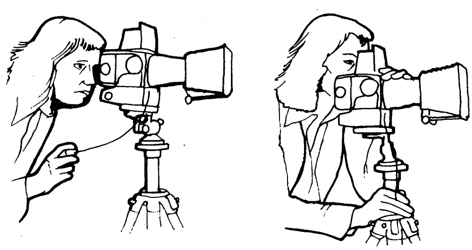
Camera Steadiness When Using a Tripod

Tripods and cable releases are excellent accessories for improving camera steadiness, but using either or even both is no assurance of picture sharpness. Two types of camera motion cause blurriness: motion or vibrations produced by the camera mechanism and motion produced by the photographer. Motion produced by the photographer may be caused by not holding the camera steady in handheld photography or by jarring the release, which can happen with handheld or tripod mounted cameras. To minimize this happening, depress the release slowly and gently so you hardly know when the shutter clicks. With a tripod-mounted camera, a cable release serves as a flexible link between you and the camera, absorbing whatever shake your finger might produce.

Depressing the release on any SLR camera brings various camera functions into motion, which can blur an image with tripod-mounted cameras. Camera manufacturers try to dampen all these motions as much as possible, but the camera mechanisms can still produce vibrations. This is more likely to happen with medium format cameras than 35s because all the moving elements, the shutter or the rear curtain, and the mirror are larger. These vibrations do not seem to affect picture sharpness in handheld photography; the body seems to absorb the effect. But the vibrations can affect sharpness when the camera is mounted on a tripod or stand.

A camera on top of a heavy studio tripod is probably steady. On a more lightweight tripod—the kind most often used on location, when traveling—camera-produced vibration is not eliminated, especially when the center elevating post of the tripod is extended more than a few inches. The camera ends up actually sitting on a single post rather than on a three-legged extension. In this position, the camera is prone to vibrate, as you can easily see when you tap the camera. A cable release does not in any way reduce these camera-produced vibrations.

To minimize camera shake, hold the camera as firmly as you do in handheld work. Lay your own weight on top of the camera, pressing the tripod and camera to the ground. Using this approach, which may be opposite from what you have been told, allows you to use lightweight tripods without suffering image blurriness. This approach, however, works only with exposure times up to 1/2 or 1 second. It does not work for longer exposures because you will not be able to keep your body steady long enough.



When exposure times exceed 1 second, your body and hands should not be in contact with the camera; use a cable release. For shorter exposure times, steady the camera by pressing it firmly toward the ground with your hands and face.

Mirror Lockup

Motion in SLR cameras is produced by the mirror, the rear curtain, the aperture close down, and the shutter, especially a focal plane type. It is logical to perform as many of these motion-producing functions as possible before the exposure is made. The camera feature that will let you do this is the pre-release or mirror lockup.

When the pre-release is depressed, the mirror lifts up, and the camera performs all the other functions it needs to do before the shut-

ter can make the exposure. Now you can wait a second or two to let the camera settle down before you push the release. Pre-releasing a camera does not eliminate the motion produced by the shutter. In this respect, pre-releasing the camera is more helpful with lens shutters, which produce practically no motion when opening or closing. The pre-release or mirror lockup is one of the most important features of an SLR camera. Use it whenever you work from a tripod or camera stand. Use it also when making long-time exposures with a cable release.

The pre-release or mirror lockup can also serve the other purpose of eliminating the time delay between releasing the camera and the moment the actual exposure is made. This delay is short, but nevertheless exists on SLR cameras. With the camera pre-released, the exposure is made the instant you depress the release.

A 10x magnified image shows the difference in sharpness from a tripod-mounted camera when the mirror is locked up (left) and when the mirror lockup is not used (right). Shutter speed was 1/8 second with a 150 mm lens. A cable release was used for both.

SELECTING A TRIPOD

Maximum camera steadiness would call for the largest, heaviest studio tripod, but when tripods are used out in the field, you need to make a compromise between steadiness and portability.

A medium format camera does not necessarily require heavier gear than a 35 mm camera. You can achieve excellent steadiness with a relatively lightweight model if the tripod is used, as discussed before. When long telephotos are used, tripod size must be more seriously considered.

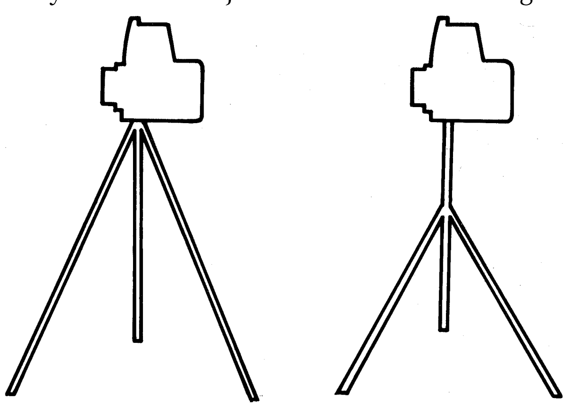
A tripod must be designed for fast, convenient operation so that it is a pleasure to work with rather than a nuisance. The attributes I recommend you look for in a tripod are, in order of importance: steadiness; ease of setting up; convenience in viewing and operating the camera;

quick camera mounting and release; convenient adjustment of camera height and angle; portability; tripod head locks strong enough to hold any combination of equipment in all positions; and the possibility of changing lenses and film magazines without having to remove the camera from the tripod.

All tripods are made for what could be called normal shooting heights (5–6 ft.). For photography from lower levels, some tripods are made so that the legs can be spread beyond their normal position. Other tripods allow you to attach the camera to the bottom of the center post, or the center post can be inserted upside down so the camera sits between the legs.

Center Post

The most solid, vibration-free camera support is obtained when your camera sits directly on top of three legs, not on top of a single post. If you raise the center post of your tripod extensively, camera steadiness is jeopardized, and the advantage of a heavy tripod with good leg construction may be nullified completely. On the other hand, an elevating extension is convenient for lowering or raising the camera, so try to compromise. Never consider the center post as part of the tripod height. Raise the tripod as high as you have to with the three legs, and use the center post only for minor adjustments in camera height.



A camera sitting directly on top of the three tripod legs (left) is much less susceptible to vibration than one sitting on top of an extended center post (right). The center post should be used only for minor height adjustments.

Tripod Head

The tripod head must hold the camera without putting excessive pressure on the locking levers, not only when the camera is in a horizontal position, but also when it is tilted up or down with any of the lenses and accessories you normally use. The platform of the head should be large enough to hold the camera so it does not easily move when the

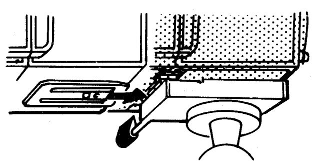
camera controls are operated or when the film is advanced. Neither the platform nor any other part of the tripod should interfere with camera operation.

You can decide between tripod heads with separate locking levers for the different movements or a ball head, which allows moving the camera in any direction and is locked with a single locking knob. I prefer ball heads. For me, it is too time-consuming and too confusing to operate separate locking levers.

Coupling

Cameras can be mounted on a tripod by means of a locking screw from underneath the platform. Attaching and removing the camera in this fashion is inconvenient and time-consuming because the locking screw is not easy to reach and practically impossible to adjust with gloves. Locking screws can also be dangerous because they can be forced into the camera body, causing damage to the inside of the camera.

These problems are eliminated with a tripod coupling, which allows instant attachment and removal of the camera. The coupling is attached either to the tripod or the camera and left there, becoming part of the tripod or the camera. The camera is then simply placed on the tripod and locked with a single lever. To remove the camera, you simply slide it off the tripod.



A tripod quick coupling permanently attached to the tripod head or camera saves you time when working with a tripod. Slide the camera onto the accessory or tripod head and lock it in place.

Tripod Screws

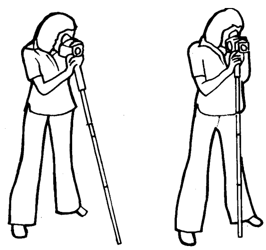
Cameras may be equipped with either the small so-called American type or the larger European type or both. Tripod couplings usually have both so they are usable with any camera.

MONOPODS

Excellent camera steadiness can be obtained with a monopod, which is easier to carry and quicker to set up than a tripod. A monopod may not guarantee sharp images at a 1-second shutter speed, but it is possible to obtain sharp results down to 1/4 second. Considering the convenience in carrying, also serving as a walking stick during a hike, and the short set up time, a monopod is well worth considering.

Most photographers keep the monopod straight up when taking pictures. This is not the best solution for camera steadiness. In this vertical position, the monopod is free to move in all directions and keeping it steady is difficult.

For the steadiest monopod operation, place the bottom of the monopod 2 or 3 feet in front of you, tilt the monopod toward you so the monopod forms the third leg of a tripod, with your own legs as the other two. With your elbows pressed against your body, place both hands on the camera, or one hand on the camera and the other on top of the monopod, and press the eye and forehead against the viewfinder eyepiece. Depressing the camera release is preferable to using a cable release.



The steadiest position for a monopod is when it forms the third leg in combination with the photographer's two legs and the face is firmly pressed against the camera (left). When the monopod is vertical, keeping the camera steady is more difficult (right).

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CHAPTER 8

Lens Design and Performance

The medium format camera best suited for your photography may be, and often is, determined by the lens or lenses. If you are in the market for a camera, it is worthwhile considering the following points:

- type and range of available focal lengths; location of the lens scales and convenience of operating the lens controls;
- extent and desirability of automation; and
- the manufacturer's reputation for quality and reliability.

LENS COST

Lenses are an expensive part of a good camera system with a single lens perhaps costing more than the camera body. Medium format lenses are likely to cost more than equivalent 35 mm lenses because the lens elements, the lens barrel and diaphragm, must be larger. Increasing the size of a lens element increases the cost drastically. The medium format lens requires a larger piece of glass, and more time is needed to grind and polish the larger surfaces to perfection.

Selecting a high-quality lens is a wise decision, especially in the medium format. Most photographers move up to the medium format to get better image quality. It makes no sense to sacrifice some of the benefits of working with the larger image by using an inferior lens, especially since the larger medium format negative or transparency shows up lens deficiencies more than the 35 mm frame. With the films of yesterday, differences in the quality of lenses were not so obvious or even

visible. This is not so today. The films available today are capable of resolving more detail than most of the lenses are capable of recording, so lenses, not film types, are the limiting factor in image sharpness.

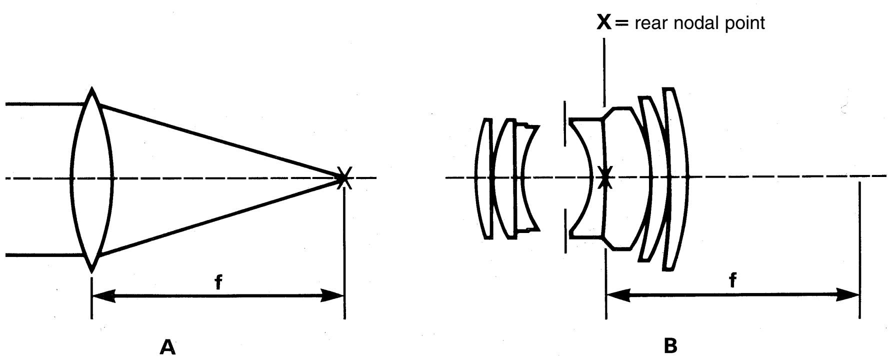
To be happy with your medium format camera system and to achieve competitive results, evaluate the quality of the lenses and the entire camera system very carefully. As films likely will be further improved, purchasing a good quality lens and camera is the best investment for the future.

FOCAL LENGTH

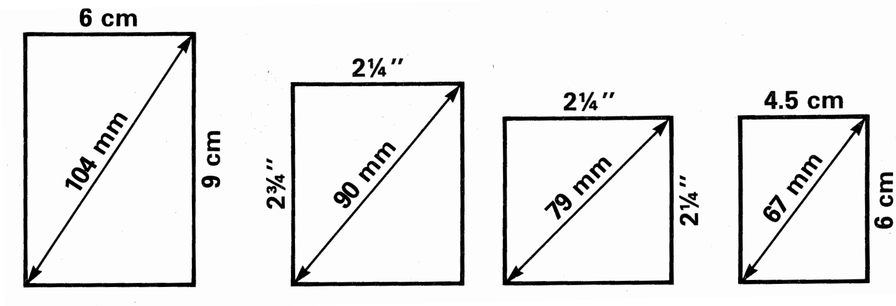
Focal length is an optical characteristic built into the lens. Focal length is the same regardless of whether the lens is used on camera, enlarger, or projector. You do not change focal length by adding extension tubes or bellows (they simply move the lens physically farther away from the image plane), by switching a lens from one camera to another, or by using a specific lens for different film formats. For example, a 150 mm lens remains a 150 mm lens whether used on a 4 × 5 in., a 2 1/4 in. square, or 35 mm camera.

You can change focal lengths by adding or removing optical components, such as a teleconverter. A Proxar or close-up lens is also an optical component. It changes the focal length, but to such a small degree as to be negligible. The purpose of adding close-up lenses is to allow photography at closer distances.

On zoom lenses, focal length can be changed within a certain range by moving some of the optical components inside the lens.



On a single lens, the focal length is the distance from the lens to the point where the lens forms an image of a subject at infinity (A). On a compound lens, the focal length is measured from the rear nodal point (X), which is known to the lens designer only, but shown on some lens specification sheets (B).

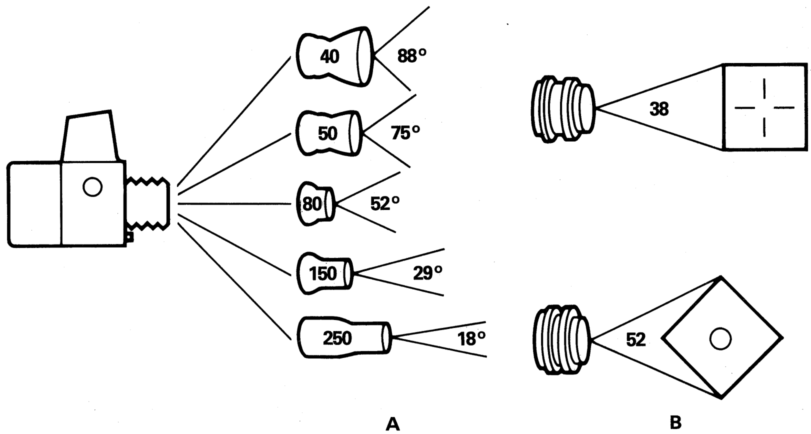


A standard lens has a focal length approximately equal to the length of the format diagonal. This is about 45 mm for a 35 mm frame. The length of the diagonal, and thus the standard lens for the various medium formats, is shown here.

To classify lenses into standard, wide angle, and telephoto, consider the focal length in relation to the format. A lens is considered standard when the focal length is about equal to the diagonal of the picture format for which it is used. An 80 mm lens is normal on a 2 1/4 in. square camera because the diagonal of the 2 1/4 in. square is 78 mm. Lenses with focal lengths shorter than the diagonal of the picture format are classified as wide angles, and those of longer focal lengths as telephotos.

ANGLE OF VIEW

The *angle of view*, as the name indicates, is the angle the lens "sees" when it is used on a specific camera. The angle of view can be related to the picture format in three ways: in relation to the diagonal, the vertical, or the horizontal side of the negative. On the 2 1/4 in. square format, the two are equal. For example, the 80 mm lens used with the 2 1/4 in. square has a horizontal angle of 38° and 52° diagonally. Used on the 4.5 × 6 cm format, the angle of view is still 38° related to the long side, but only 46 degrees diagonally and 28° related to the short side. Any lens that has a diagonal angle of approximately 50° is considered standard. When the diagonal angle is larger than 50°, the lens is considered wide angle, and when it is smaller, a telephoto.



The focal length of a lens in relation to the picture format determines its angle of view. The longer the focal length, the narrower is the angle of view for the same format (A). The angle of view can be expressed in relation to the picture diagonal or to the horizontal or vertical. The two are different (B).

Lens makers commonly give diagonal angles of view. This makes sense for the lens designer because the lens produces a circular image that must cover the square or rectangular format. For practical picture taking, however, this figure is useless. As a photographer, you must think of horizontal or vertical coverage. What you normally want to know is what focal length is necessary to cover the same width on a smaller or larger negative. The angle of view can be calculated, but it is simpler to use the following chart.

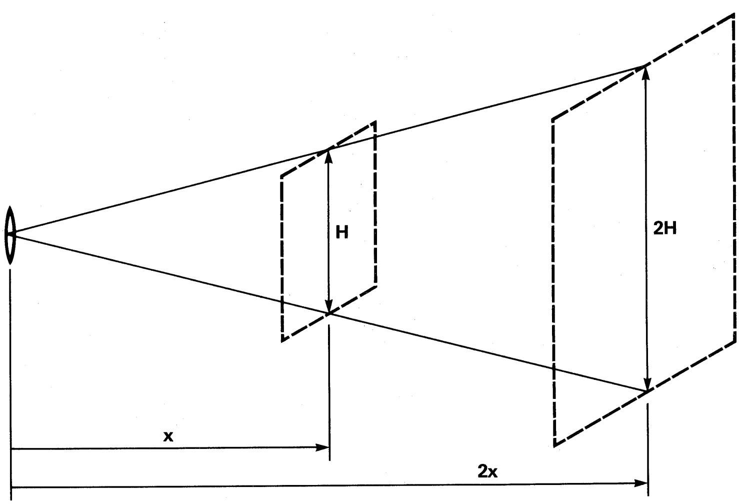
The chart shows equivalent focal lengths for 35 mm; 2 1/4 in. square and 6 × 4.5 cm; 6 × 7 cm; and 4 × 5 in. The figures are based on the horizontal coverage (that is, the long side of the negative). As an example, to cover the same width of an area as an 80 mm lens on 2 1/4 in. square or 6 × 4.5 cm (angle of view 38°), you need a 52 mm lens on 35 mm, 100 mm on 6 × 7 cm, and 175 mm on 4 × 5 in.

AREA COVERAGE

The angle of view determines area coverage. The area coverage for any lens is directly proportional to the subject distance. At twice the distance, a lens covers an area twice as wide—at half the distance, half as wide. A larger area coverage means that the subjects are recorded smaller.

EQUIVALENT FOCAL LENGTHS FOR DIFFERENT FILM FORMATS

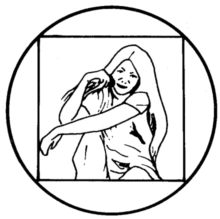
	Focal Length of Lenses (mm)			
Horizontal angle of view (degrees)	*4.5 × 6 cm 2 1/4 in. square*	*35 mm 24 × 36 mm*	*6 × 7 cm*	*4 × 5 in. 98 × 120 mm*
84	31	20	38	67
72	28	25	48	83
69	40	26	50	87
65	43	28	54	93
62	46	30	58	101
58	50	33	63	109
54	54	35	68	117
49	60	39	75	130
40	76	50	96	167
38	80	52	100	175
36	84	55	105	183
32	100	65	125	218
30	105	69	131	229
26	120	78	150	261
24	130	85	163	283
23	135	88	169	295
21	150	100	190	330
15	206	135	259	450
13	250	163	314	545
10	306	200	383	667
9	350	229	439	763
7	458	300	575	1000
6 1/2	500	327	627	1090



At twice the distance, a lens of a specific focal length covers an area twice as wide and four times as large in area.

COVERING POWER

Covering power is not the same as area coverage. Lenses are designed in the factory to cover a certain image size with satisfactory sharpness and illumination. Since all lenses produce a circular image, this so-called covering power of a lens can be indicated by the diameter of the circle in which definition and illumination are satisfactory.



Covering power of a lens is the diameter of the circle within which satisfactory image quality and illumination are obtained.

The diameter of this circle must be at least as large as the diagonal of the image format for which the lens is designed, for example, 79 mm for the 2 1/4 in. square. Such lenses for the 2 1/4 in. (55 × 55 mm) square are designed to produce the promised image quality and corner illumination on the 2 1/4 in. (55 × 55 mm) square and not necessarily beyond. They are not likely to perform properly for the larger 6 × 7 cm format.

The *covering power* is a function of the format for which the lens is designed, not the focal length. For instance, 50 mm lenses can be designed to cover nothing larger than the 35 mm frame, or the larger 2 1/4 in. square, or even the 4 × 5 in. or larger sheet film sizes. If lenses designed for a smaller format camera are used on a larger format, the corners are beyond the covering power of the lens. They may be completely vignetted, or the illumination and image quality in the corners is unsatisfactory.

Lenses designed for a large format camera, however, can be used for a smaller format. Lenses designed for the 4 × 5 inch format could be used for the 2 1/4 in. format, and medium format lenses can and are being used on 35 mm cameras with adapters.

The covering power of a lens increases as the lens aperture is stopped down. The covering power is also greater when the lenses are focused at closer distances. The differences are insignificant in the medium format, but must be considered when working with large format cameras.

LENS APERTURE

The *lens aperture* determines how much light reaches the film at a given moment. The *f* stop number is the focal length of the lens divided by the working diameter of the lens. It used to be said that the working

diameter is the diameter of the front element. This is the case on some lens designs, but not on others. The working diameter is the diameter of the entrance pupil, a measurement known only to the lens designer, but also published in some lens specification sheets.

LENS NAMES AND ENGRAVINGS

Many medium format camera lenses today carry only the name of the camera and/or lens manufacturer in addition to the focal length and maximum aperture, and all lenses made for a specific camera and/or made by the same company carry the same names. These lens engravings give no hint of the lens type or lens design.

Quality lenses made in Europe still carry today, as they have done for more than a hundred years, not only the name of the manufacturer, but also a name that specifies the lens type and lens design. Before the computer age, designing a new lens was a time-consuming process, and when completed, many lenses were considered great accomplishments that justified a special recognition—a special name. Many lens designs made the lens designer famous. Two of the most known camera lenses, the Tessar and Planar, are known as the work of Dr. Paul Rudolph, the Biogon is the work of Dr. Ludwig Bertele.

European-made camera lenses still use this system today. These lenses have different names indicating a specific lens design, not meaning that one design is better than another, but simply that a specific design was selected as the best suitable choice for that particular focal length and use of lens. Lenses with the same name may be available in different focal lengths, may be made for different camera formats or for different camera makes, or may be made for film cameras as well as cameras for digital recording.

As long as the lenses have the same name, they are basically the same lens design.

Here are a few examples from the Carl Zeiss line:

- The Tessar is a classic four-element lens design that was often referred to as the eagle eye of the camera.
- Tele Tessars are optically true telephotos consisting of a positive front section and a negative rear section, separated by a large air space.
- Planar lenses are of a symmetrical design.
- Biogon is an optically true wide angle design.
- Distagon is a retrofocus wide angle design.
- Grandagons from Rodenstock are wide angle lenses with a large covering power to allow shift and tilt motions.

Some of these lens designs were accomplished a long time ago. The Planar design goes back to 1896. This naturally does not mean that today's Planar lenses are identical to those designed years ago. Today's lenses have the same basic design but the modern lenses have newer glass types, different curvatures and perhaps also more lens elements to match the quality of today's lens to the quality of today's high-resolution films.

TELEPHOTO LENS DESIGNS

It is common in photography to classify all lenses with a focal length longer than normal as tele or telephoto lenses. In the optical field, such lenses are separated into long focal length types and optically true telephotos.

An optically true telephoto is a specific lens design with a positive front and a negative rear section. The principal plane, from which the focal length is measured, is not within the physical dimension of the lens, but somewhere in front of the lens. The advantage of the true telephoto is that the physical length of the lens can be much shorter than its focal length. True telephoto lenses are shorter, lighter, and easier to carry and use. Because of these advantages, practically all long focal length lenses used in photography are optically true telephotos.

Most modern telephoto lenses also have internal focusing. The focusing is accomplished optically, not by moving the entire lens further away from the image plane. The physical length of the lens, therefore, does not change.

Apochromatic Lenses

A lens element disperses white light into the different colors of the spectrum as a prism does. The different colored rays form their images at different distances from the lens and consequently also produce images of different sizes. One of the tasks of the lens designer is to correct this so called chromatic aberration and come up with a lens design where the different colored light rays produce images of the same size on the same plane.

The most important task is to correct every lens as well as possible for the blue and red colors of the spectrum without necessarily being too concerned about the other colors, which are known as the secondary spectrum.

Camera lenses in the standard, wide angle and shorter telephoto focal lengths that are well corrected for blue and red, can produce superb image sharpness even on today's high-resolution films.

Long focal length lenses corrected for red and blue only, on the other hand, may produce a color fringe or a slight softness along sharp dividing lines between light and dark colors. This effect of residual chromatic aberration may not be objectionable or even noticeable if "ordinary" photographic images are not enlarged beyond common standards. If an apochromatic lens is available for your camera, you should consider it for the best image quality with long focal length lenses, especially in the medium format. Apochromatic long focal length lenses are clearly promoted as apochromatic types, or as Apo lenses, by the manufacturers.

Apochromatic lenses are corrected not only for blue and red, but green as well, and perhaps even for some or all the other colors between red and blue. The Carl Zeiss Superachromats, for example, are for all practical purposes fully corrected for all the colors in the spectrum.

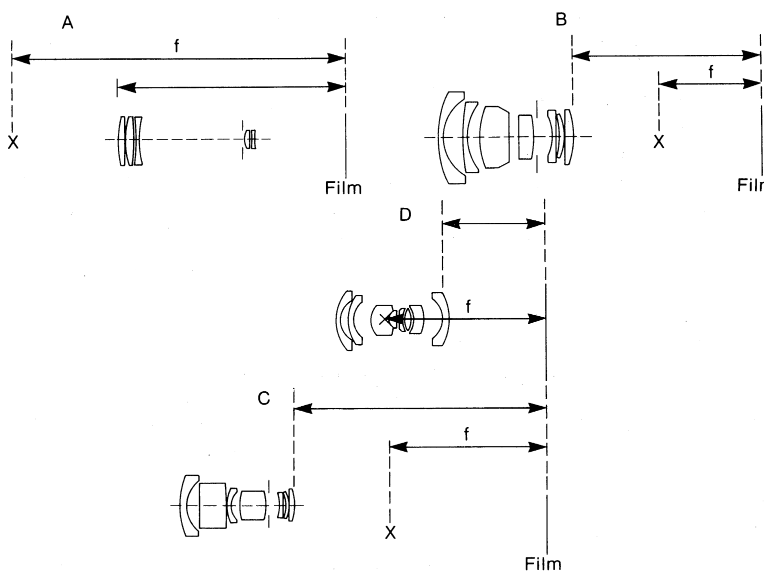
This extensive correction for chromatic aberration is accomplished in many apochromatic lenses with some lens elements made

from other materials than glass, for example, fluorite, which is an artificially crystallized form of calcium fluoride, or from a glass blended with fluorite.

These crystals may be more sensitive to temperatures than glass, making the focus setting somewhat dependent on the temperature. Always focus such a lens visually on the focusing screen, not based on the distance setting on the focusing ring. For example, don't just set the lens at infinity because the subject is far away. Focus as you normally do on the focusing screen. To accomplish focusing at infinity, the focusing ring on such a lens may also turn beyond the infinity setting.

Long Telephotos at Closer Distances

As the focal length increases, so does the minimum distance at which the lens can be focused. The relatively long focusing distances of telephoto lenses give some photographers the impression that these long lenses are meant for long distance photography only. This is not so. The focusing distances are limited for mechanical design reasons, but telephoto lenses can be used at closer distances in combination with close-up accessories. Extension tubes are best for this purpose.



An optically true telephoto lens (A) is physically shorter than its focal length. The point from which the focal length is measured (X) is in front of the lens. In a retrofocus wide angle design (B), the rear nodal point from which the focal length is measured (X) is not inside the physical dimension of the lens but behind it. The retrofocus wide angle design (C) is necessary on an SLR camera. The rear element of the lens is far enough from the film plane to clear the mirror. An optically true wide angle (D) where the nodal point is within the physical dimension of the lens, does not provide this space.

WIDE ANGLE LENS DESIGNS

From a photographic point of view, all lenses with a focal length shorter than standard are wide angles. From an optical design point of view, such lenses can be of two different types.

Optically True Wide Angle Design

Wide angle lenses on large format cameras usually are the true optical wide angle design. The same lens design is found on some non-SLR medium format cameras.

The principal plane (nodal point) from which the focal length is measured is within the physical dimension of the lens as it is with standard focal length lenses. Because of the short focal length of wide angle lenses, the image is formed closely behind the lens with the rear element of the lens positioned close to the image plane. On the Hasselblad Superwide, which uses the optically true Zeiss Biogon lens design, the rear lens element is only about 18 mm from the image plane.

This leaves no room for a mirror to move up and down between the rear element and the image plane as is necessary on an SLR camera. Such lenses, therefore, cannot be used on SLR cameras.

Optically true wide angle lenses are known for their superb image sharpness and minimum degree of distortion, the best that can be obtained from a wide angle lens. This lens design also maintains excellent image sharpness over the entire focusing range from infinity to its minimum focusing distance. Optically true wide angle lenses are excellent not only for architectural work, but also for critical close-up photography.

For the very best in corner-to-corner sharpness—for architectural, product, or scientific photography with a super wide angle lens or for photogrammetric applications that require view camera quality without distortion—true wide angles should be considered if they are available in the proper focal length.

Retrofocus Wide Angle Designs

The long back focus necessary to accommodate the mirror motion in SLR cameras can be obtained in another wide angle lens design known as *retrofocus*, sometimes referred to as an inverted telephoto design. On the retrofocus lens design, the principal plane from which the focal length is measured is not within the physical limits of the lens, but behind the surface of the rear lens element. The distance between the image plane and the rear element can be longer than the focal length of the lens. Wide angle lenses on SLR cameras are of this retrofocus design.

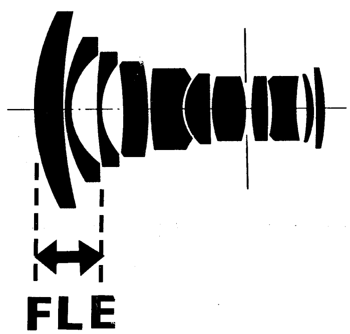
While retrofocus designs have a somewhat higher degree of distortion, they can have excellent image sharpness at long distances. The long back focus, however, makes it difficult to correct a retrofocus lens to a high degree over the entire focusing range. A compromise is necessary. Retrofocus lenses are designed to provide the best image quality at

long distances where they are normally used. It is recommended to close the aperture when photographing at closer distances below 7 feet (2 meters) to maintain corner-to-corner sharpness.

Floating Lens Element Design

Lens designers have found a way to improve the image quality of retrofocus type lenses at closer distances with a lens design with floating lens elements (FLE)—sometimes also described as a close range correction. Some of the elements within such a lens are "floating." That means these elements move automatically or must be moved manually to a slightly different position depending on the distance setting on the lens. If the floating lens elements must be moved manually with a separate lens control, always set the floating element control first to the proper position before you focus the lens with the normal focusing ring. Do not focus the image first and set the FLE calibration ring afterwards. The image will be out of focus.

On some FLE wide angle lenses, the floating lens elements are moved automatically when the focusing ring is turned, eliminating the need for a separate adjustment. Floating lens element designs may not produce better image quality at long distances, but will definitely do so for close-ups.



In a floating lens design, some lens elements are moved depending on the subject distance to provide good image quality at long and short distances.

Fish-eye Lenses

Wide angle lenses that produce straight verticals and horizontals over the image area are also referred to as rectilinear wide angle lenses. This is in contrast to fish-eye lenses, which have rectilinear distortion.

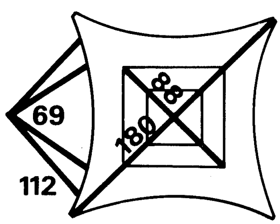
In a fish-eye design, the diagonal angle of view, which is usually around 180°, is completely out of proportion to the horizontal or vertical angle of view and is not related to the focal length of the lens. For example, you can find fish-eye lenses with a 180° diagonal angle of

view with different focal lengths. The fish-eye lens design produces a curvature in all straight lines that do not pass through the center of the image. The effect is one of greatly exaggerated barrel distortion resulting in strangely beautiful images.

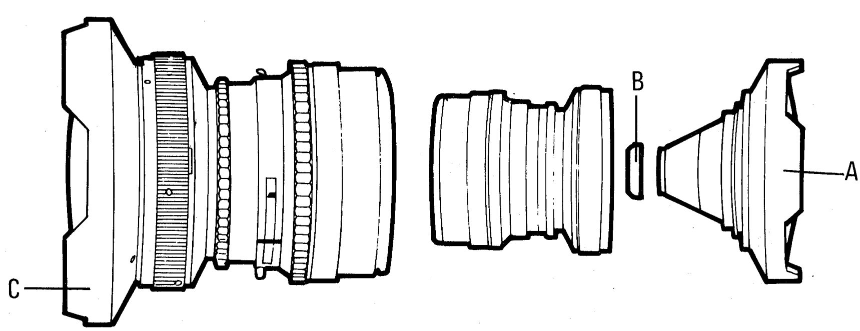
Some fish-eye lenses in 35 mm produce a circular image that covers only the central area of the film. The effect can be striking, but it is largely the circular image that attracts attention. The subject, usually reproduced on a small scale, is often secondary. The effect wears off quickly, and such pictures start to look alike. Such lenses have limited application in serious photography.

Other fish-eye lenses cover the entire image format from corner to corner like any other lens. They are known as full frame fish-eye types. The focal length is long enough to produce a relatively large image in the center, while at the same time also embracing surrounding subjects from corner to corner within a 180° panoramic field. The distortion of the fish-eye lens is completely unrelated to sharpness. Such lenses can produce good sharpness and even illumination from corner to corner even with the lens aperture wide open.

Full frame fish-eye lenses have excellent applications in any field of photography as they allow us to record subjects different from the way we see them with our eyes.



On a full-frame fish-eye lens, the 180° diagonal angle of view is completely out of proportion to the 112° horizontal or vertical angle. This diagonal angle of view, which is twice as much as the 88° angle of an extreme wide angle, produces the curved lines in the fish-eye image.



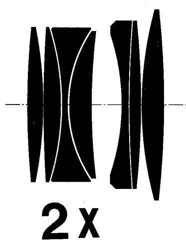
The 180° angle does not allow using a lens shade or filters on a fish-eye lens. A shade (C) may be part of the lens. The lens may be designed to take filters (B) inside the lens after you detach the front section (A).

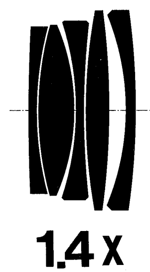
CHARACTERISTICS AND USE OF TELECONVERTERS

Teleconverters, also called tele extenders, are optical components with several lens elements. They are combined with a regular camera lens with the teleconverter mounted between camera and lens, like an extension tube. The teleconverter increases the focal length of the camera lens. A 2× converter doubles the focal length of the lens. Combined with a 250 mm lens, we end up with a 500 mm focal length. A 1.4× converter increases the focal length 1.4 times, so the focal length of a 100 mm lens is increased to 140 mm. A 1.7× converter changes the 100 mm lens into one with a 170 mm focal length.

Some teleconverters can be used with all lenses in a camera system; others are made for specific lenses only either for optical or mechanical reasons. Check the manufacturer's specification sheets. If you work with a zoom lens, also check whether the teleconverters can be used with zoom lenses and if so, what image quality can be expected.

Compact size and low weight is one of the advantages of teleconverters. You can obtain a longer focal length by carrying a physically shorter lens and a compact converter. This fact is appreciated especially when traveling and carrying equipment on airplanes. Being able to use a converter with various lenses is another nice advantage. With three lenses and one converter, you end up with six different focal lengths if the converter can be used with all three lenses.





Quality teleconverters may have as many or more lens elements than a prime lens. A 2× extender left, a 1.4× extender right.

Focusing Range and Area Coverage with Teleconverters

The focusing range of the prime lens is maintained when combined with a teleconverter. If a 180 mm lens, for example, focuses down to 5 feet (1.55 m), it still focuses down to 5 feet when combined with a converter. That means we have a 250 mm (with 1.4×) or a 360 mm (with 2×) lens that focuses as close as 5 feet—probably closer than a telephoto lens of the same focal length.

A converter might even serve as a close-up accessory instead of, or in addition to, an extension tube. For example, if a lens covers an 8-inch area at the minimum focusing distance of the lens, it covers an area as small as 4 inches from the same distance when it is combined with a 2× extender.

Exposure with Teleconverters

While teleconverters have many good advantages, they have one drawback—loss of light. With any 2× converter, the light that reaches the film is reduced by two *f* stops. A 2× converter combined with a 50 mm *f*/2 lens results in a 100 mm focal length with a maximum aperture of *f*/4. A 1.4× converter causes a loss of one *f* stop. A 1.7× converter causes a loss of 1 1/2 *f* stops.

Before purchasing a teleconverter, determine whether this light loss may become objectionable in your field of photography and, if so, whether investing in a longer and faster telelens may be a better choice.

You must compensate for the loss of light caused by teleconverters when taking a meter reading with a separate exposure meter. If the light is measured through the lens with a meter built into the camera or meter-prism viewfinder, you need not worry. Whatever the built in meter shows is correct, since the light is also measured through the teleconverter.

Image Quality with Teleconverters

When lens components, such as those in a teleconverter, are added to a lens, image quality changes. How much depends on the quality of the teleconverter and the quality of the lens with which it is combined. A prerequisite for achieving good image quality with any teleconverter is using a high quality camera lens in front of the converter. A lens of questionable quality is likely to produce unsatisfactory results when used with any converter. A 2× converter doubles the faults in the prime lens and makes them more visible.

A teleconverter's performance is also determined greatly by the design of the lens with which it is used. Since lens design varies, the performance of the teleconverter varies somewhat from lens to lens. Teleconverters are usually designed to provide the optimum quality with one specific lens or a range of lenses. The lens manufacturer may have that information available.

It is generally best to invest in a teleconverter made by the same company as the lenses you use on your camera. Such a converter is likely to perform better since it is designed with these lenses in mind. Such a converter can produce an image quality that is equal, or almost equal, to that of a prime lens, especially the longer focal length lenses with which it is usually combined. Such a teleconverter may have as many or more lens elements than a prime lens and may cost almost as much as a prime lens.

If there is an image quality falloff, it is mainly at the edges and may not be objectionable (in portrait photography, for instance). You can improve the quality by stopping down the lens.

ZOOM LENSES

On a zoom lens, the focal length is changed by moving some of the lens elements internally. The ratio between the shortest and the longest focal

length is known as the zoom range and is 2:1 or 2× for a zoom lens going from 60 mm to 120 mm as might be the case for a zoom lens for a medium format camera.

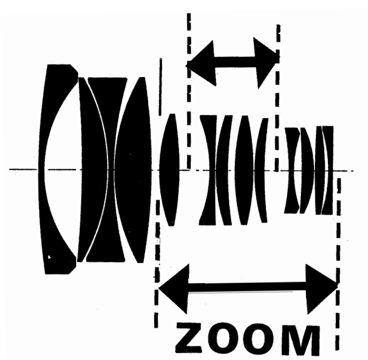
The zoom range remains the same regardless how and where the lens is used. When a zoom lens is set to a specific focal length, it creates an image that is identical to that created by a fixed focal length lens of the same focal length on the same film format.

Zoom lenses with shorter zoom ranges, as those available for medium format cameras, usually maintain the same maximum aperture throughout the entire zoom range. Others may have a slightly reduced maximum aperture at one end of the range. The reduced *f* number of these variable aperture lenses is usually indicated with smaller numbers behind the maximum aperture. The designation may read *f*/3.5 in large letters and *f*/4.8 in small letters. Most professional photographers select constant aperture lenses mainly because they have found that such lenses usually also have better image quality.

On many zoom lenses, in 35 mm, focusing and zooming is accomplished with the same control—zooming by moving the control back and forth, focusing by turning the control. Such an arrangement has advantages for fast action work.

On medium format zoom lenses, the zoom and focusing motion is accomplished with two separate, usually rotatable, controls. This is preferable for most medium format applications, especially when you want to photograph the same subject at different focal length settings.

When investing in a zoom lens for a camera, make certain that you select what is known as an optically true zoom, a lens that does not need to be refocused when the focal length is changed. Most zoom lenses for better cameras are of this type. While the image with such a zoom lens stays in focus, you can expect a critically sharp image only if the zoom lens is focused critically. To be assured of this, do manual focusing always with the lens set at the longest focal length, regardless of the focal length that is actually used. At the longest focal length, the image has the greatest magnification, the depth of field is at the minimum, and focusing is therefore most accurate.



The focal length of a zoom lens is changed by moving some of the lens components. Focusing may be accomplished by moving another optical section indicated by the arrow on top.

Zoom lenses on projectors often need refocusing when zooming, which is not a disadvantage in this application.

The Operation Advantages of Zoom Lenses

Zoom lenses can reduce the number of lenses that have to be carried. This can be true even with the limited zoom range of medium format lenses. A wedding photographer working with a 2 1/4 camera may be able to cover the entire wedding with one zoom lens going from about 60 to 120 mm.

A zoom lens reduces or eliminates the need to change lenses. Lens changes are time consuming, especially when each lens needs to be set to the correct aperture, shutter speed, and distance. The focal length on a zoom lens can be changed without necessarily disturbing the other lens settings. You are always ready to shoot; you can take a long shot followed almost instantly by a closer view. All images made with the same zoom lens at any focal length have the same color rendition.

Disadvantages of Zoom Lenses

Zoom lenses need to be physically larger, with the length of the lens and the diameter of the front element usually directly related to the zoom range, or determined by the shortest or the longest focal length depending on the optical lens design. Size and weight must be considered, especially if the zoom lens is used as an all-around tool for all photography.

To keep the size, weight, and cost down, the maximum aperture is reduced with the difference amounting to at least one, perhaps two or even more *f* stops compared to a standard fixed focal length lens. With the limited zoom range in the medium format, you must also determine to what extent the lens can replace fixed focal length types.

Image quality is not a main determining factor in medium format zoom lenses. You can find zoom lenses today that closely match the sharpness of a high quality fixed focal length lens. The quality, sharpness, distortion, and illumination naturally vary from one focal length to another. If you want to evaluate a zoom lens, you must test it at different focal lengths.

MAKRO LENSES

Makro lenses for 35 mm cameras have a longer focusing range than "ordinary" lenses, allowing you to photograph at closer distances without having to use close-up accessories.

Such lenses are not available for medium format cameras because the larger diameter of the lens barrel and the resulting heavier weight make it difficult to extend the focusing range. Most medium format close-up work requires the use of accessories that do not complicate such photography to a great extent. A medium format camera with a bel-

lows between camera body and lens can accomplish some of the tasks of a makro lens. Before investing in such a camera, however, consider the camera size and operating convenience carefully.

Some camera lenses are called macro, not because they focus closer, but because they are optically designed to produce the best image sharpness at closer distances. The Carl Zeiss Makro Planar is of this type. This is worthwhile to know since all camera lenses are designed to produce the very best image quality at a specific distance or range of distances. Unless specifically indicated, we can assume that camera lenses provide the very best image quality at longer distances, but also produce acceptable or even good quality at all distances within the focusing range of the lens.

SOFT FOCUS LENSES

Soft focus lenses, available for some medium format cameras, produce an image that is superimposed with circles of diffusion to give the image a luminous appearance. This effect is often desired in portrait and fashion photography and in advertising images of beauty products where the soft effect adds a more glamorous feeling to the image.

The soft focus effect can be created in the lens by undercorrecting the lens for spherical aberration in combination with a disc with different size openings in the lens. The degree of softness depends on the lens aperture, providing a large degree of softness at large apertures, little or almost sharp images when the lens aperture is closed down. The diaphragm must be set at the aperture that produces the desired degree of softness. I feel this is a serious disadvantage. In most applications, the lens aperture must be determined and set for the desired depth of field. Using a soft focus lens also means that all soft focus images must be produced at the focal length of that particular lens.

A similar and equally pleasing softness, can be added to an image by attaching a soft filter to the front of an ordinary sharp lens. Soft focus filters can be attached to any focal length lens (as long as the filter is as large as the front diameter of the lens) allowing you to create soft focus images with standard, wide angle, and telephotos at a fraction of the cost of a soft focus lens.

Soft focus filters can produce the softness in different ways. One is by scattering of the light before it enters the lens with a pattern of transparent and nontransparent areas on the filter. In another method, the image softness is achieved with a number of spherical mini-lenses of different diameters on one of the filter surfaces. This is, for example, the principle in the Carl Zeiss Softar filters.

Soft focus filters can have other advantages. The degree of softness can be the same at all lens apertures. This allows you to set the lens aperture for the desired depth of field.

Good soft focus filters can maintain image sharpness. They can produce the softness with diffused outlines by bleeding the highlights into the shaded areas without blurring the image and creating the impression of blurriness. This is extremely important.

Soft focus images must have sharpness somewhere within the image to look natural. Our eyes are not accustomed to see things that are completely blurred. We always expect to see something sharp whether we look at the actual subject or a photographic image. So, whatever soft focus device you plan to use, assure yourself that it maintains image sharpness and does not produce an overall blur.

Effective soft focus images cannot have an overall blur, but have to give the impression of sharpness. Note the sharpness in the eyes, eyelashes, and lips. Taken with a Carl Zeiss Softar soft focus filter.

LENS QUALITY

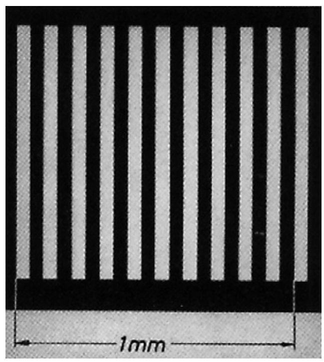
The quality of a photographic lens is not determined by the number of elements it comprises but by the skill of the designer in combining the minimum number of elements to produce the best quality image, using the latest design techniques and types of glass. The quality of the final lens is determined even more by the accuracy with which each lens element and each mechanical component of the lens mount is made and assembled, and how carefully and thoroughly the finished lens is tested.

The overall sharpness or quality of a lens used to be, and still is in some cases, expressed by resolution: the number of lines per millimeter a lens is capable of reproducing as separate lines. Lens and photo technicians have found, however, that image quality in a photograph is not so much determined by the resolution of fine detail as by the manner in which the more easily perceptible, larger structural elements in the picture are reproduced. This is more a question of contrast rendition. Edge sharpness (called acutance), not resolution detail, is what gives a photograph the appearance of sharpness.

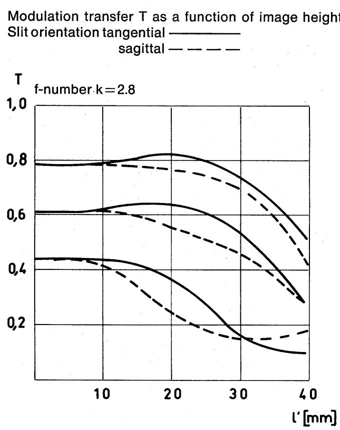
The image forming qualities of a lens are best expressed with modulation transfer function (MTF) diagrams. They are used throughout the camera lens industry. Some manufacturers publish these diagrams; some do not. The diagrams can be helpful to determine the performance of a lens or to compare the performance of different lenses made by the same company.

MTF diagrams cannot necessarily be used to compare the quality of lenses made by different companies. There are no standards within the industry. Most companies publish these diagrams based solely on the computer printout—what the lens design should produce based on its design—not taking into account the manufacturing precision.

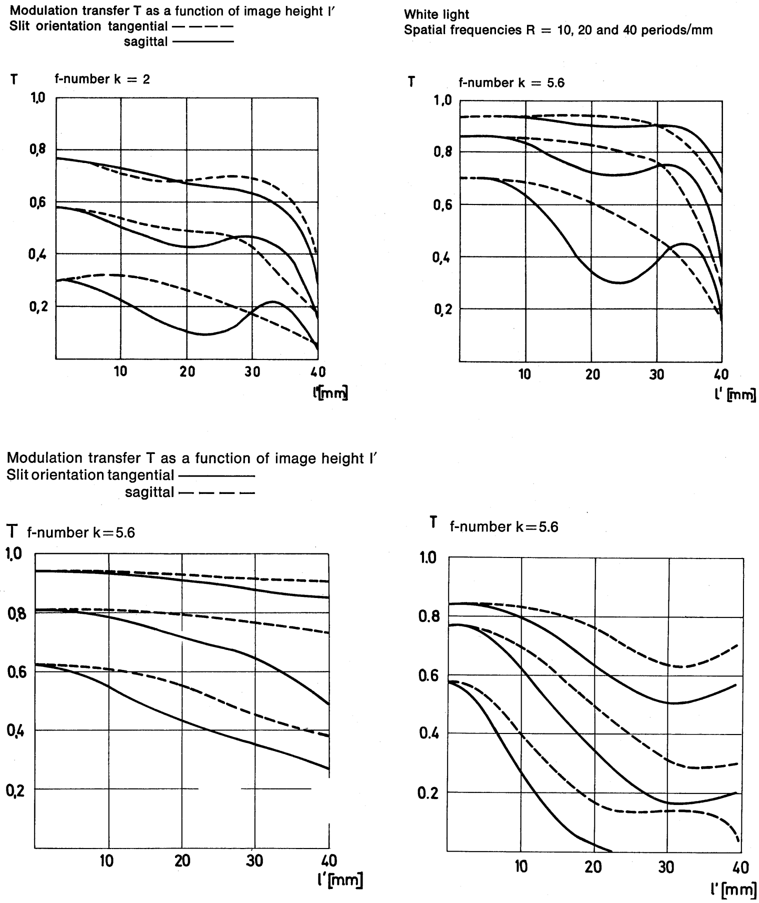
Some companies publish the MTF curves for the actual finished lens—the lens you buy and use for your photography. Such curves are based not only on the design, but also take into account the manufacturing precision that determines the final performance of a lens to a very great extent. Carl Zeiss is one of the companies that publishes the actually measured data of the finished lens.



The quality of a photographic image is not so much determined by the number of lines that are resolved, but by the edge sharpness, which is called acutance. Images look sharp with sharp edged lines rather than a gradual transition from white to black.



An MTF diagram shows contrast transfer curves for three spatial frequencies of perhaps 10 (top), 20 (middle), and 40 line pairs per mm (bottom). The solid line is for sagittal orientation, the dotted line for tangential orientation. The quality in the center of the image is at the left with the distances from the center marked in mm (10 to 40) at the bottom. The curves thus show the quality difference between the center and the edges of the image.



MTF curves are usually published for the maximum lens aperture (*f*/2 top left) and with the aperture somewhat closed down (*f*/5.6 top right). These diagrams show whether the quality improves by closing down the aperture (top). MTF diagrams also allow comparing the quality of different lenses made by the same company (bottom). The diagrams for both lenses apply to *f*/5.6.

Image Quality at Small Apertures

Image sharpness improves as a lens is stopped down. As a general rule, the best image quality appears two to three *f* stops below the maximum (*f*5.6–*f*8 for an *f*2.8 lens). There are also medium format lenses that produce superb sharpness with the lens aperture fully open. If a lens aperture must be closed more than two *f* stops to obtain corner-to-corner quality, I consider it a poor lens.

When a lens aperture is closed down beyond certain limits, the nature of light can affect the sharpness of the image. Light pouring through a small opening such as the minimum aperture of a lens spreads slightly

at the edges, an effect known as *diffraction*. This diffraction can degrade the sharpness of the image regardless of the lens design or precision of manufacturing. On high-quality lenses, however, the minimum aperture is usually limited to a point where the degradation of the image may not be noticeable and not objectionable. With such a lens, you need not be concerned about closing the aperture too far and losing quality, so do not hesitate to stop the lens down completely if you need a small aperture for the required depth of field. The lack of sharpness caused by limiting the depth of field is often more noticeable than the loss of overall definition caused by diffraction.

Making Your Own Quality Test

A film test is the only practical way for most of us to determine the quality of a lens.

Making your own film test is not a nuisance; it is the most reliable quality measurement. Such a test takes into account not only the performance of the lens itself, but also other sharpness determining elements as well, especially the film flatness of the camera.

Load the camera with the highest resolution film that you can find. This is probably a low-speed, or special type, black-and-white or color transparency film. Photograph a subject with fine detail. Brick walls always come to mind first, but they actually are poor subjects. The brick itself has little fine detail, and the contrast range is low. You need high contrasts for easy evaluation, such as white window frames against darker walls, a black railing in front of a light building in the distance, newspaper pages, or good lens test charts at close distances.

Test the lens at different apertures and evaluate the image sharpness in the center and at the edges.

To conduct a reliable test, you must keep a few other points in mind:

1. When comparing lenses of different focal length, move the camera to different distances so each lens covers the same image area.
2. Make certain that each negative or transparency has exactly the same exposure and development.
3. Make certain that the test target is lighted evenly and identically for each lens you test.
4. The test target must be flat or the subject far enough away so you need not worry about depth of field. The film plane must be parallel to the test target.
5. Eliminate any possibility of camera motion.

Evaluate the center and the corners of the actual negative or transparency with an 8× or 10× magnifying glass. Never evaluate prints made from a negative or slides projected on a screen because too many other factors can enter in and distort the results. Evaluate the center and corners.

LENS FLARE AND MULTICOATING

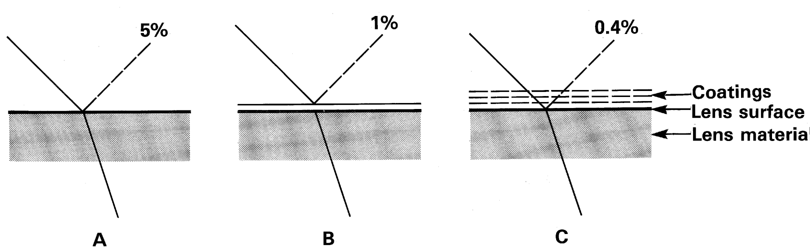
Besides sharpness, a quality image needs a good contrast with clear highlights and deep black areas. Images with a haze-like appearance, called *flare*, are unacceptable for most uses. Flare is likely to appear with any lens on any camera if the sun or a bright light source shines directly on the lens surface. Flare may also show up with some lenses when the subject or scene includes very bright areas, bright white skies, snow, sandy beaches, water with reflected sunlight, and bright white backgrounds as often used in fashion and high key pictures. Flare can be created by light reflections on lens surfaces, the interior of lens barrels, or camera bodies.

Multicoating

Coating and multicoating of lens elements has reduced the possibility of flare to a point where well-designed, multicoated lenses can produce color and black-and-white images with excellent contrast even if the subjects include bright, reflecting areas.

All modern medium format camera lenses are multicoated. A multicoated lens has several layers of coating, each one of a different thickness based on the wave length of the different colored light rays. A good multicoating with six to seven layers corresponding to the colors of the spectrum and applied to every glass/air lens surface reduces the amount of light that is reflected off each lens surface to less than 1/2 percent.

Light can be reflected not only by the lens surfaces, but also by the lens barrel as well as the inside of the camera body. Some camera and lens manufacturers pay special attention to this problem by designing and finishing the lens barrels and the inside of the camera to reduce or eliminate a possible flare problem from these surfaces.



An uncoated glass surface reflects about 5 percent of the light (A). Coating (B) and multicoating (C) reduce the amount of reflected light, resulting in a reduction of flare.

Lens Shades

While multicoating produces images with good contrast, it has not reduced or eliminated the need for lens shades. Lens shades serve a dif-

ferent purpose than multicoating. The purpose of multicoating, and the coating of the interior of lenses and camera bodies with a dull black finish, is to reduce reflections from the light that actually goes through the lens to form the image in the camera. The purpose of a lens shade is to eliminate light that serves no purpose for creating the image from reaching the front of the lens.

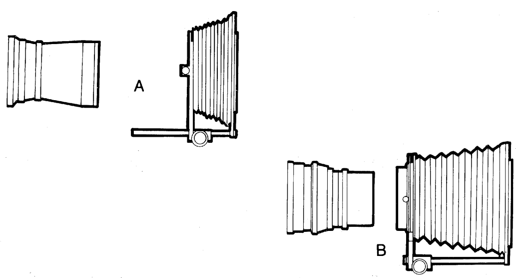
Lens shades are especially important when photographing toward light sources, against white backgrounds or bright areas in general (including overcast white skies, water, sand, and snow).

The regular round lens shades are compact and provide good, but not necessarily the most effective shading. Square or rectangular shades that conform to the image format are more effective. The longer the focal length of the lens, the longer such shades should be. It is wise to invest in the best shade for each lens, even if a different shade is needed for each lens. With zoom lenses, lens shades can only be as long as suitable for the shortest focal length of the lens and are somewhat of a compromise.

In the medium format field, you find bellows shades, often called professional lens shades. The length of the shade can be extended to match the focal length of the lens, thus providing the best shading for all lenses. In addition, one and the same shade may be usable with all focal length lenses. You, therefore, need to carry only one shade.

While you should use the longest possible shade for each lens, you must also make certain that the shade does not vignette the corners of the image. Usually a check on the focusing screen is sufficient; a film test, photographing evenly lit surfaces, is better. In either case, make the test with the lens completely closed down because vignetting in the corners becomes more visible at small apertures.

Lens shades can also protect a lens from possible physical damage and from rain or snow.



A bellows shade can be extended more or less to provide maximum shading for different focal length lenses, from wide angle (A) to telephoto (B). The bellows shade may have a slot for inserting gelatin or square resin filters.

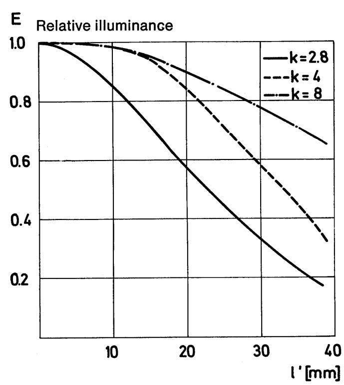
RELATIVE ILLUMINANCE

With every lens, the corners of the image receive somewhat less light than the center. Some of the light loss on standard and longer focal

length lenses is caused by the lens design or the desire to reduce the diameter and/or length of a lens. On other lenses, especially the wide angle types, the major loss of light is caused by physical limitations in the lens barrel. Light rays that enter the lens at steep angles, as they do on short wide angle lenses, may be cut off by mechanical components in the lens barrel. Even if such physical limitations do not exist, there is darkening by natural light fall off. The aperture and/or shutter opening in the lens is smaller for light rays that enter at an angle than for those that enter straight from the front. From the front, the opening and the entrance pupil is a full circle with the largest possible diameter. From the side, the same opening and the entrance pupil is elliptical and greatly reduced in area, and also reduces the light that can go through. On high quality medium format lenses, the reduction in the corner illumination usually does not exceed an acceptable limit of one *f* stop at maximum aperture. The difference is always reduced by stopping down the lens.

If a lens cannot be made with acceptable corner illumination, the darkening can be made less noticeable or eliminated completely by reducing the illumination that goes to the center of the image. This is done with center gray filters that are placed in front of the lens. They even out the difference between the center and corner illumination, but also reduce the light that reaches the image plane. Exposure must be increased usually by 1 or 1 1/2 *f* stops. Such filters are necessary on some lenses for panoramic cameras and extreme wide angles for large format cameras.

Some lens manufacturers publish the data for relative illuminance. Like MTF diagrams, the illuminance is shown with the lens aperture wide open and somewhat closed down, and also with the center of the image with full 1.0 or 100 percent illumination at the left and the distances from the center indicated on the horizontal axis. If the right end of the curve reaches 0.5, the light loss at the corner is equal to one *f* stop, which is usually not noticeable and hardly objectionable on any lens.



The relative illuminance of lenses is shown in diagrams with the 100 percent illumination in the center of the image at left. The image distances from the center are indicated in mm at the bottom (10 to 40 mm) The illumination is shown at different apertures, illustrating that corner illumination improves as the lens aperture is closed down.

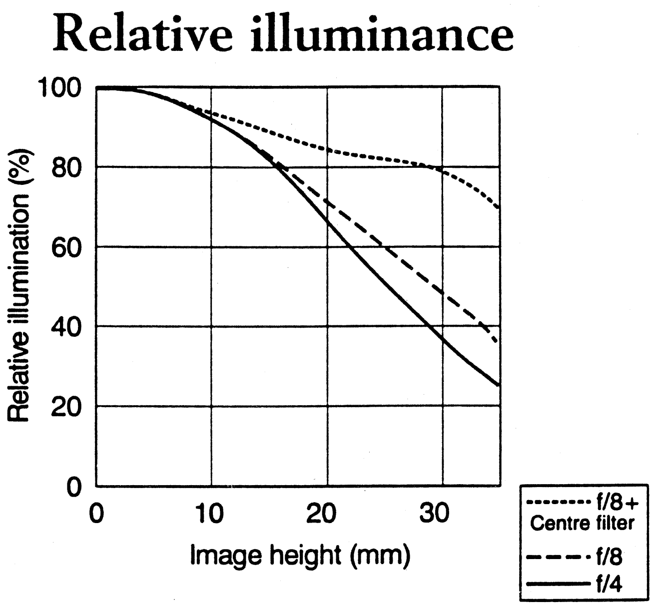


Diagram shows the improvement in corner illumination by using a central gray filter (dotted line on top) on an extreme wide angle lens.

COLOR RENDITION

Color rendition has to do with the color of the image that is produced in the camera. Some lenses are known to produce a warmer image (more red) some a cooler one (more blue). The color rendition is determined mainly by the glass used in the lens. Some types of glass used in modern lenses are not absolutely clear but have a tint of one color or another and act like a color filter. Color rendition is to a minor degree also affected and determined by the lens coating. Individual broadband coating of the various lens surfaces can help in producing matched lenses.

Color rendition is not a major problem if we are only concerned with one image. Our eyes adjust easily when viewing individual images. It becomes a major concern, however, with sequences of images seen next to each other or one right after the other as in a slide projection. The slightest color variations become obvious, often objectionable to any viewer.

Since sequences of images are frequently taken with different focal length lenses, accurately matched color rendition in all lenses is extremely important on any camera. Color rendition can vary especially between lenses made by different companies. While it is possible to match colors with filters, it is highly recommended to use lenses made by one and the same manufacturer on a camera system used for color photography.

If different images, long shots, and close-ups can be made with one and the same zoom lens, you need not worry about this problem.

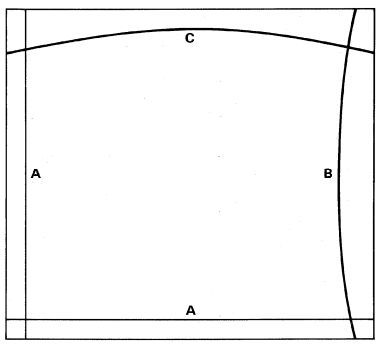
IMAGE DISTORTIONS

Lens Distortion

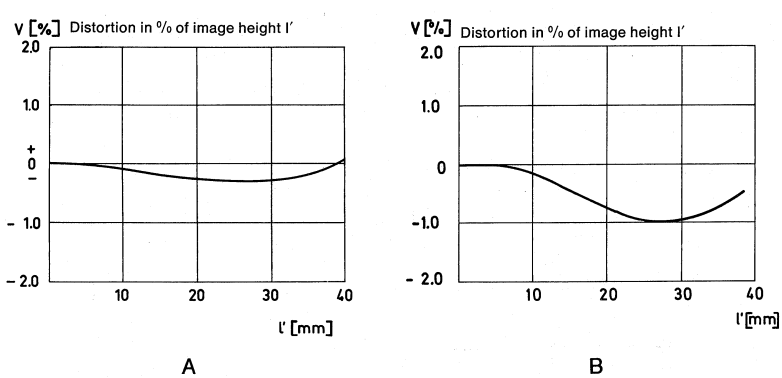
Lens distortion refers to the lens's inability to record straight lines as straight lines over the entire film area. Straight lines near the edges appear curved, either outward in the corners—referred to as pincushion distortion—or inward, called barrel distortion.

In some photographic fields, such as portraiture, the degree of distortion correction is less critical than in architectural, product, and scientific photography. Lenses used in these fields of photography should not exhibit any noticeable degree of distortion. Lens distortion is the same at all lens apertures.

The inability of producing an image with perfectly straight lines is the only distortion caused by the lens and the lens design.



A lens corrected for distortion records straight lines straight over the entire image area (A). Insufficient distortion correction shows up as curved lines near the edges. An inward curvature is referred to as *pincushion distortion* (B), and an outward curvature is known as *barrel distortion* (C).



In a lens designer's diagram, distortion is shown as a percentage of image height. The two diagrams show the difference in distortion between an optically true wide angle lens (A) and a retrofocus lens (B)

Other Image Distortions

Various other effects that appear in photographic images are called distortions and are frequently blamed on the lens. We often refer to distortion when a subject, or part of a subject, close to the camera appears too large in relation to the rest of the subject or scene. A typical case is a portrait where the nose appears too large in relation to the rest of the face. We often blame the lens, usually the wide angle, for this problem because this effect is more likely to appear in wide angle pictures. The effect is, however, not the fault of the lens, and distortion is not the proper name for it.

Foreshortening. *Foreshortening* is the proper term for the effect mentioned above. It is not caused by the lens but by the camera being too close to the subject. It is a problem of perspective and created by the shooting distance. At close distances, the difference in size between subjects closer and further from any camera lens is exaggerated. The foreshortening shows up more often in wide angle pictures only because wide angle lenses are more likely used at close distances. Foreshortening is reduced by the photographer shooting from a longer distance, if necessary with a longer lens to maintain the size of the foreground subject. In a portrait, you must be at least three feet (1 m) away from the person to avoid this effect with any lens on any camera. You want to use a short telephoto for a head and shoulder shot.

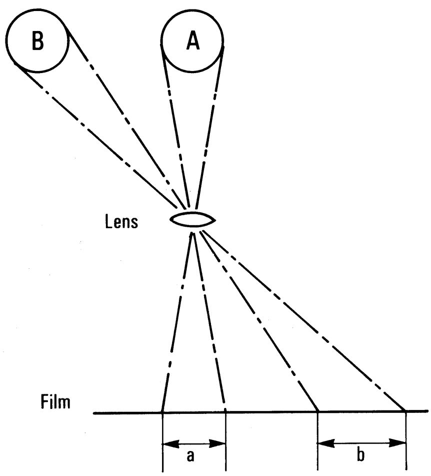
Wide Angle Distortion. Another type of distortion occurs when three-dimensional subjects are photographed with wide angle lenses. The objects at the side or corner of the image appear wider than those in the center. A perfectly round chandelier appears egg shaped in the corner of the picture. A person's face is distorted as often seen in banquet, news, and documentary pictures made with wide angle lenses. As this effect becomes obvious and objectionable in pictures taken with wide angle lenses, it is called wide angle distortion. In spite of the name, the lens does not cause the effect. It happens in pictures taken with the best, distortion-free wide angle lenses.

The major cause of wide angle distortion is the flat image plane in the camera. Based on pure geometry, three-dimensional objects appear elongated when projected at an angle on the flat plane.

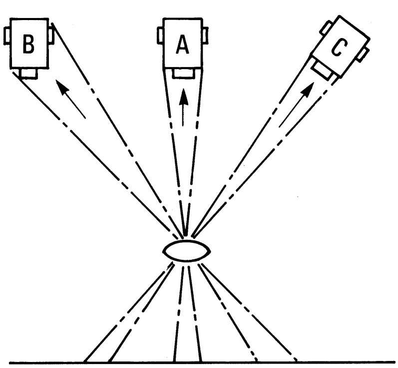
There is a second reason for three-dimensional objects on the sides appearing distorted. The wide angle lens sees such objects on the sides and corners from a different angle than those in the center. In a group of people, for example, the lens looks at the front of the face of the people standing in the center but sees the side of the head of those standing at the left and right. This is exactly as we see the people if we place our eye where the camera lens is. With our eyes, however, we do not see the people in the center and at the edges at the same time. We must turn the head to do so. As a result we are not aware of the different point of view. In a photograph where we see all the people without turning the head, the distortion becomes quite obvious.

In group or product pictures, turning the people or products so they all face towards the center of the lens can reduce the distortion. The lens now sees each person or product from the same angle. In situations with nonmovable objects, such as a room interior, try to make the composition so that objects that may easily look distorted do not appear on the edges or corners of the frame.

Wide angle distortion happens only with three-dimensional, not flat subjects. It does not occur, for example, in copying.



A round subject at the edges (B) becomes elongated when traced onto the flat film plane. Image distance (b) is greater than distance (a) for the same three-dimensional subject in the center.



When photographing a group of people, wide angle distortion is further emphasized because the lens photographs the side of the head of people standing on the sides (B), while it photographs the front of the face of those standing in the center (A). You can greatly reduce the distortion by turning the people on the sides so that the lens also sees the front of the face (C). The same procedure can be used when photographing a row of products.

Slanted Vertical. Slanted vertical lines are frequently referred to as distortion and sometimes blamed on a wide angle lens. Tilting the camera causes slanted lines. This places the image plane at an angle to the subject. Slanted lines happen with all lenses if the image plane is not parallel to the subject. Wide angle lenses enhance the effect.

Slanted lines can look completely natural, for instance, in an image of a skyscraper or a tall tree. To see the skyscraper or tree all the way to the top, we must tilt our head and by doing so we also see slanted lines. When looking at "ordinary buildings," we do not tilt the head so such buildings only look proper in a photograph with perfectly straight and parallel lines. Slanted lines are not acceptable as they appear to me as a technical fault.

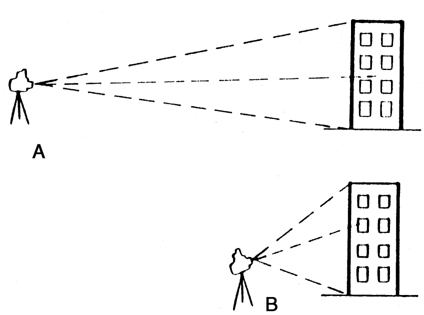
Vertical lines are vertical and parallel to each other when the image plane on any camera and with any lens is parallel to the subject plane, that is, when the camera is perfectly level.

With short focal length lenses, leveling the camera is more critical and must be done more accurately. Horizontal and vertical guidelines on the focusing screen can help. A spirit level—if available for your medium format camera as an accessory or built into the camera or tripod coupling—may be an even better choice for critical leveling of the camera.

Slanted lines can sometimes be avoided, or at least reduced, by photographing from a longer distance with a longer focal length lens. The longer distance may eliminate or at least reduce the need for tilting the camera. This approach, of course, only works when there is room to move away from the building, which is often not the case, and when there are no ugly telephone and power lines in front of the building.

If none of the above approaches work, you can try cropping the bottom part of the image, perhaps making a square out of a vertical image.

With negative film, you can also straighten the verticals in enlarging by tilting the easel perhaps in combination with tilting the negative plane. The same option exists today electronically with images produced on any type film. Although this possibility exists today, I still suggest trying to record the verticals straight in the camera if at all possible, if only because it takes a fraction of the time to do so in the camera that it does in the computer. Ways to accomplish this are discussed in the next chapter.



The longer focal length lens used from a longer distance requires less tilting of the camera to cover the same area.

Including an effective foreground can make the wide angle shot more attractive and eliminate the need for cropping the bottom.

CHAPTER 9

Lens Controls for Creating Images

AREA COVERAGE

Focal length determines area coverage. The shorter the focal length is, the wider the area that is covered by the lens. Wide angle lenses, thus, can be used to cover a larger area without having to move the camera; telephotos allow you to enlarge distant details.

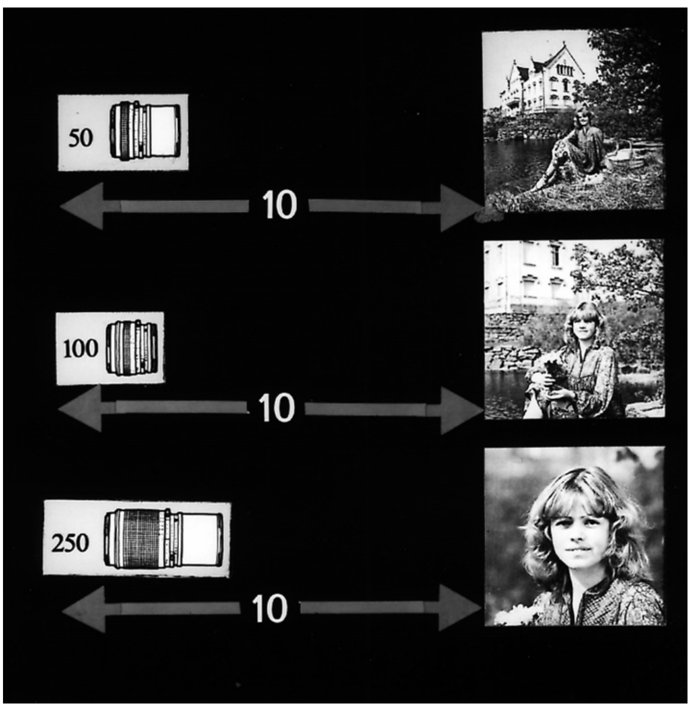
Changing lenses is frequently more convenient than moving the camera, especially if it is mounted on a tripod. Often it is the only possibility; for example, the size of a room may prevent you from moving farther away.

While area coverage is a good reason for using different focal length lenses, lenses can do much more than just cover larger or smaller areas. They can be major tools for creating effective, beautiful, unusual, and interesting images.

PERSPECTIVE

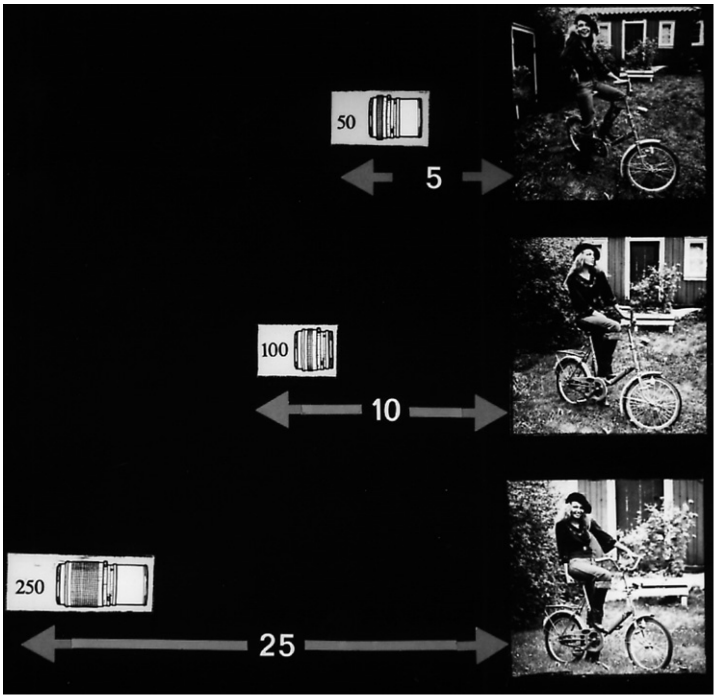
Perspective refers to the size relationship between subjects close and far away. With our eyes, area coverage and perspective do not change. The normal focal length lens on a camera records images in a perspective very close to what we see with our eyes. That is a main reason such lenses are called normal or standard. If you want to create images as we see the world, photograph the scene with a standard lens. In legal photography, it is important that the scene be presented in court in the normal perspective. A distorted perspective might present objects to the court in a completely different light.

The area coverage of a 1000 mm focal length (500 mm + 2× teleconverter) (left) compared to a standard 80 mm focal length (right).



Because different focal length lenses cover different sized areas, you can take a long shot, a medium shot, and a close-up without moving the camera by changing from wide angle to standard to telephoto.

In photography, we can change the size relationship between foreground and background by changing the camera distance, then using a camera lens to maintain the size of the foreground subject. The background then becomes larger, appears closer with a longer focal length lens, or smaller and further away with a wide angle.



Different focal length lenses (wide angle top, standard center, telephoto bottom) can be used from different distances so the foreground subject is recorded at the same size. The difference between the three images is then in the size of the covered background area, the background sharpness, and the perspective.

Rooms photographed with a wide angle lens appear longer because the furnishings in the back appear smaller. With telelenses, background subjects are recorded larger; they appear closer, and perspective is compressed. Long telephotos are perhaps the greatest tool to give outdoor scenes a special look. Background areas, such as the distant mountains, become a more dominant part of the image and can greatly enhance the composition of the various elements.

When a wide angle lens is used, the background subject appears much smaller in relation to the foreground (top), and the background subject appears to be farther away than it does when it is photographed with a telephoto (bottom) from a longer distance to maintain the size of the foreground subject.

Perspective is determined by the viewpoint (the camera position)—not by the focal length of the lens. But different focal length lenses are needed to cover the foreground subjects in a specific size.

To make the discussion complete, I must mention that the perspective in a print or a projected transparency is determined by the viewing distance. Every photographic image is seen in the correct perspective when the viewing angle corresponds to the angle at which the image was photographed. This means that you need to view wide angle pictures from a closer distance than those taken with telephotos. Since we normally view all prints of a certain size and all transparencies projected on a specific size screen, from the same distance, the different perspective in wide angle and telephoto pictures is maintained when viewing prints or projected transparencies in this fashion.

Effective Wide Angle Photography

With wide angles used from a close distance, the subjects in the foreground are oversized in relation to the rest of the image. When using wide angle lenses outdoors, don't just consider using them for the purpose of covering larger areas. Look more for possibilities of enhancing the depth, the three-dimensional aspect of the scene. Wide angle lenses are great for that purpose. You can create this feeling for depth by including foreground areas and making such areas an important part of the image—perhaps leading the eye towards the background. Even small subjects such as flowers and leaves can be considered when composing wide angle shots.

Foreshortening

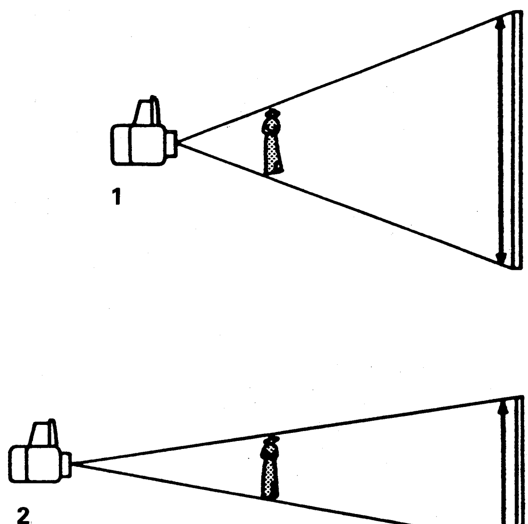
The exaggerated size of foreground subjects, also referred to as *foreshortening*, is frequently referred to as distortion and the lens is often blamed for this effect. Foreshortening is caused by the photographer shooting a subject too close so that the subject closest to the camera appears excessively large in relation to the subjects further away. The photographer, not the wide angle lens, must be blamed for this effect. Photographing a person from less than 3 ft. makes his or her nose, the feature of the face closest to the camera, appear too large in relation to the eyes and ears. To avoid this problem, select a short telephoto so you can take the portrait from a longer distance.

SELECTIVE BACKGROUNDS

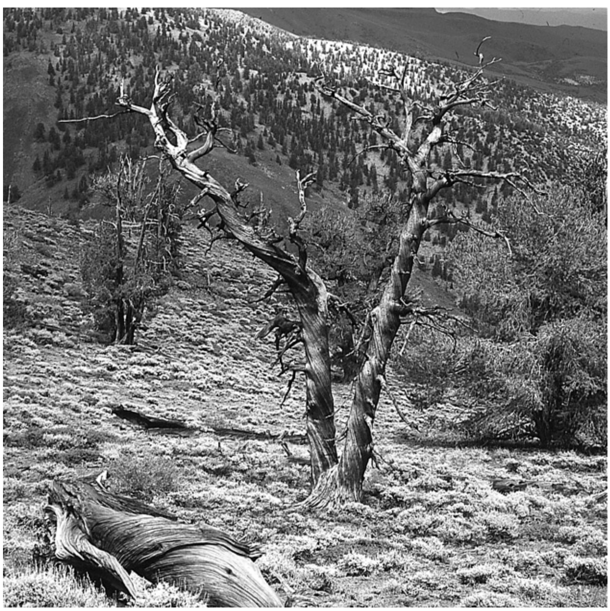
Backgrounds are an important part of most images, and the effectiveness of many photographs and slides is determined mainly or completely by the type and background area included in the image. Different focal length lenses can be used to change the background area without changing the size of the foreground subject. Photographers often overlook this technique.

Instead of photographing a subject with a standard lens from, say, 10 ft., you can photograph it with a 2× telephoto from 20 ft. The size of the subject remains the same, but the covered background area is only half in size.

Longer focal length lenses permit us to reduce background areas and by doing so, frequently eliminate distracting background elements, such as billboards, cars, people, or direct light sources. Longer lenses are valuable in the studio because they allow you to use smaller backdrops. In a formal outdoor wedding picture or portrait, the longer lenses may be preferable as they produce a smaller, blurred, undisturbing background. In a candid shot, however, including a large background may be desirable as a means of identifying the location. By photographing the wedding couple with a wide angle, you might be able to include the entire church in the background, not only the front door and the entrance steps. Do not hesitate to use a wide angle in such an application if it yields the desired background coverage. Wide angle, and even fisheye lenses, have become popular with professional portrait photographers for location portraits and celebrity pictures.



A short focal length lens from a short distance (1) covers a large background area. A longer lens from the necessarily longer distance (2) covers a smaller background area. The size of the main subject is the same with both lenses.



With a shorter focal length lens, the large background area with a large part of the sky is somewhat distracting (top). A similar set of bristlecone pines in the same area but photographed with a longer lens that eliminated the sky and placed the trees against an undistracting area of the distant mountains (bottom).

SLANTED VERTICALS

Vertical lines, such as the lines of a building, appear in the finished picture vertical and parallel to each other only if the image plane in the camera is parallel to the subject, regardless what lens or camera is used. If the suggestions made in Chapter 8 do not work, there are various ways of creating straight verticals.

Straight vertical lines look so much better not only in professional architectural work, but even in souvenir pictures taken during our travels.

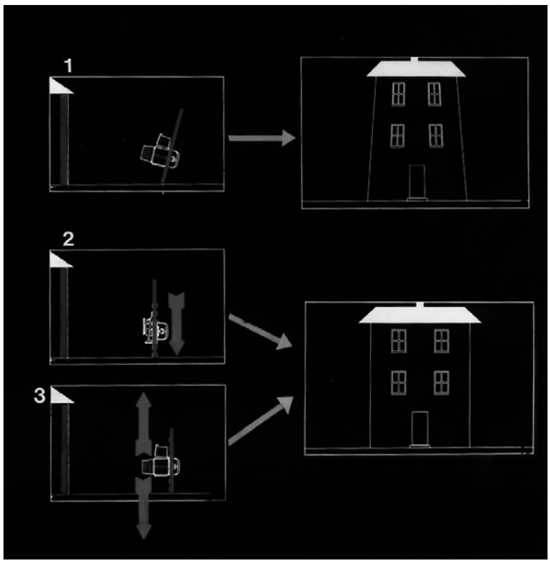
Straightening Verticals with Shift Control

One solution for keeping the image plane parallel to the subject is by moving it up or down in relation to the lens plane. This is not a new technique. It has been used in large format cameras ever since such cameras existed. This approach is now also possible in the medium format with special camera bodies that allow moving one plane against the other. The Hasselblad Flexbody is an example. If this camera uses the standard camera lenses, shifting, especially with wide angle lenses, is probably limited because of the limited covering power of such lenses. Check the manufacturer's specifications.

Special lenses with a larger covering power may be necessary for extensive architectural work. This is possible with other special cameras in the medium format. One such camera made for medium format roll film allows shifting the image plane only, which is all that is nec-

essary to accomplish straight verticals, another has all the shift and swing controls in the front and in the back that you normally find on a large format view camera. This camera is, however, strictly for studio use.

If the shift control on the camera only works in the vertical direction, horizontals, like the paintings on a slanted wall, can be straightened by tilting the square format camera.



The image plane can be kept vertical when photographing buildings either by shifting the image plane (2) or the lens plane (3). Both approaches eliminate the need for tilting the camera.

Perspective Control with Lenses

Instead of shifting the image plane, you can accomplish the same results by shiftng the lens plane. This is done with the front standard on a large format camera. In the medium format, it is done with perspective control (PC) lenses or PC Teleconverters. PC lenses are designed with a larger covering power. A PC teleconverter is designed to increase the covering power of the lens with which it is combined. The covering power obviously determines how much shifting capability there is. You should check with the manufacturer about this.

Investing in some kind of perspective control is worthwhile not only by a professional architectural photographer, but by anyone, even amateurs, interested in photographing the many beautiful structures that exist everywhere in the world. Images with straight and parallel verticals look so much better and more professional regardless what they are used for.

Photographic Approach with Shift Control

Regardless of whether the shift control is in the lens or image plane, start by aligning the camera so the image plane is parallel to the subject—perhaps using a spirit level, if available. Then shift the lens or image plane until the desired image area is covered. Decide on the lens aperture as you usually do—at least when using lenses from a medium format camera. If the lenses that must be used on the special body are lenses made for a large format camera, use a small lens aperture, *f*/16 or *f*/22. Large format camera lenses are designed to produce best quality at these small apertures only. Shifting does not change the focusing approach.

However, whenever a lens or image plane is shifted or tilted on any camera, the light rays entering the lens are no longer in line with the viewing axis. As a result, the top or bottom of the image appears darkened on the focusing screen, making image evaluation and sharpness control more difficult. This darkening happens only on the focusing screen, not on the image.

Fresnel focusing slides, which maintain even brightness regardless of how much you may shift or tilt, are available for some medium format camera systems that offer this image control. Because of the darkening of the viewing image, it is best to make exposure readings with a built in meter before you shift, or tilt the image or lens plane.

CREATING IMAGES WITH ZOOM LENSES

A zoom lens gives an unlimited range of focal lengths between the minimum and the maximum focal length.

Zoom lenses also have the unique capability of creating images that are completely different from the way we see the world. These images are created by the photographer zooming while the shutter is open to make the exposure in the camera. The change of image size is recorded on the film in the form of streaks, which can go from the center to the outside or vice versa. The streaks extend toward the outside when you zoom from the short to the long focal length because image size increases. Going from long to short, the image becomes smaller, so the streaks radiate toward the center.

The image recorded on the film also depends on other factors. If you alter the focal length for the entire exposure time, the image consists of streaks only; the subject itself is hardly visible. Most zoom shots are more effective when the subject can be recognized and is simply surrounded by streaks. To produce this effect, keep the focal length at a fixed setting (usually at either the shortest or longest setting) for about half of the exposure time and change the focal length only during the second half. If the total exposure time is 1 second, wait about 1/2 second before moving the zoom control.

Effective zoom shots require subjects with bright areas because these are the areas that produce the streaks. The streaks produced by the highlights are most visible if they cross darker image areas.

You can vary the length of the streaks by zooming over the entire focal length range (for long streaks) or over only a part of the range (for short streaks). Fast zooming produces faint streaks, and slow zooming more pronounced ones. Exposure time must be long enough so that you are able to rotate or move the zoom ring during the time the shutter is open. An eighth second may be sufficiently long enough but the results may be questionable. A 1-second exposure time gives you greater control. Obviously, you need a tripod for these long exposure times.

FISH-EYE LENS PHOTOGRAPHY

While circular fish-eyes have limited use as creative tools, the full-frame fish-eye lenses do. The beautiful curved lines produced by such a lens create attention, making every fish-eye image different from the way we see the world. The curved lines can also produce an image that is more moving and dynamic than one with straight horizontals or verticals. When using a fish-eye lens, try to compose the curved lines to enhance the visual effect and excitement of your subject. Fish-eye images are usually most effective when similar curved lines appear in the same location left and right, or top and bottom within the composition. If such dominant lines appear mainly on one side, the image is likely to look lopsided, and the effect is more disturbing than helpful.

In an image taken with a full frame fish-eye lens, lines need not necessarily be curved. Such images need not have the typical fish-eye appearance. Straight lines, horizontals, verticals, and diagonals that intersect the center of the fish-eye field are recorded perfectly straight.

In scenic pictures, the fish-eye look can be avoided, or at least reduced, if you aim the camera so that the horizon crosses the center of the field. An image of trees in a forest can look like a wide angle shot if you point the fish-eye lens toward the sky and compose the shot so that the tree trunks go from the corners toward the center. Circular subjects centered on the focusing screen remain perfect circles. A doughnut, a balloon, the face of a clock, or a round plate is recorded as it appears to the eye.

While such images do not have the typical fish-eye look, they are effective because they cover a 180° angle diagonally and therefore include a background area much larger than is possible with any other lens. The most interesting fish-eye images are often those in which the viewer is not aware that they were made with a fish-eye lens. The uses for these lenses are practically unlimited, whether or not the images you capture have the fish-eye look.

Fish-eye images are characterized by curved lines, giving them an attention-getting quality.

DEPTH OF FIELD

Turning the aperture ring on a lens controls not only exposure, but also depth of field, which is recognized as the distance range that produces acceptable sharpness. With the lens focused at a certain distance, say, 10 ft. the only subjects that are recorded critically sharp are subjects that are 10 ft. from the image plane. Anything closer or farther away is not as sharp, but the fall off in sharpness is gradual. Since the fall off in sharpness is gradual, there is a certain range in front of and beyond the set distance where the degree of unsharpness is not noticeable, or at least not objectionable to our eyes on the final print or the projected transparency. This range is known as *depth of field*.

Depth of field is a calculated figure not based on the design or workmanship of a lens. If one lens should give the impression of having less depth of field than another equivalent type, it could only be be-

cause this lens produces an exceptionally sharp image that makes the fall off in sharpness more visible. Depth of field is simply based on the fact that some degree of unsharpness is not recognized as unsharp when viewing a print or projected transparency of a certain size.

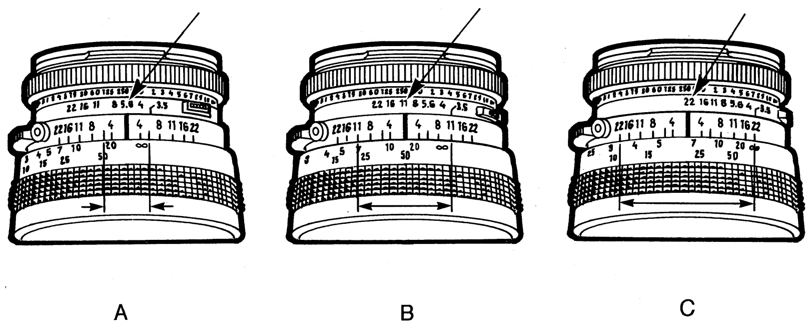
The barn across the street was photographed with two different distance settings on the lens. One picture was made with the lens visually focused on the wall of the barn, the other with the focusing ring set so the distance to the barn was close to the end of the depth of field range but within the engraved depth of field scale. The enlargements clearly show the difference in sharpness between the image focused on the wall (top, right) and the one at the end of the depth of field range (bottom).

Depth of Field Charts and Scales

Depth of field charts and scales on lenses are based on the assumption of acceptable sharpness. There can be differences in depth of field scales between different makes of lenses. This does not mean that one

company makes better lenses with more or less depth of field but just that the other company calculated their depth of field limits on a different degree of acceptable sharpness, a different size of the circle of confusion.

At normal distances, the lack of sharpness increases more rapidly in front of the subject and more gradually behind it. As a result, about one third of the total depth of field is in front and two thirds behind the focused distance. This can be seen clearly on the engraved depth of field scales. At close distances, the two are more equal.



At *f*/5.6, (A) depth of field is from 50 ft. to infinity. At *f*/11, depth of field goes from about 20 ft. to infinity (B) and at *f*/22 from about 11 ft. to infinity (C). Depth of field should always be determined from the depth of field scales on the lens.

Focal Length and Depth of Field

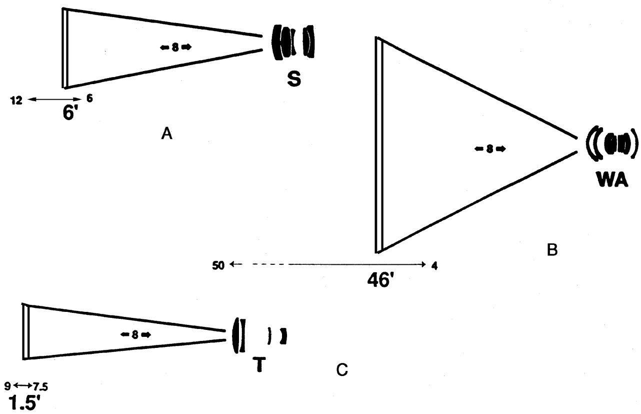
It is generally accepted that wide angle lenses have more depth of field and telephotos have less, but this statement needs some investigation. When you photograph a subject with different lenses from the same camera position, a short focal length lens gives you more depth of field than a longer telephoto. The two lenses, however, also cover completely different areas, produce completely different images. If the standard lens produces a three-quarter length portrait, the telelens gives a head and shoulder portrait, and the wide angle gives a full length shot.

Usually you work the other way around. You know the size of the subject you want to photograph, so the area coverage is pre-determined. Now you can decide whether to cover the pre-determined area with a standard lens, or with a wide angle from a closer distance or a telephoto from farther away. If you work this way, the different focal length lenses no longer provide different depth of field ranges. When you cover the same size area, every focal length lens gives the same depth of field at the same aperture.

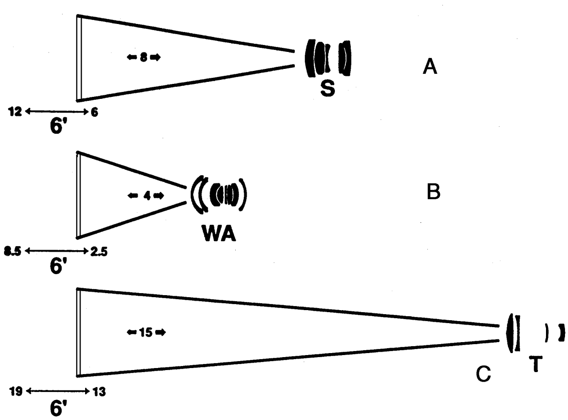
The focal length of the lens, then, really does not affect depth of field. Only the lens aperture and the area coverage, which we call magnification in close-up photography, determine depth of field. You can only change the depth of field by opening or closing the lens aperture, or by changing the area coverage. Open the aperture for less depth; close

it to obtain more depth. If you run into a situation where even the smallest aperture does not provide enough depth of field, which often happens in close-up photography, the solution is to photograph a larger area and crop later or use the tilt control if the subject is on a flat plane.

Knowledge of depth of field is most helpful in close-up photography. The area coverage is almost always pre-determined because you want to fill the frame with a subject of a specific size—a piece of glassware, a tool, or a flower. Regardless of what lens you use, the depth of field remains the same; and regardless of what close-up accessory you use to cover that area, depth of field remains the same. Close-up accessories do not determine the range of sharpness, as is often thought.



If different focal length lenses are used from the same distance, the wide angle (B) has more depth of field (46 feet) than the standard (A) (6 feet) or the telephoto lens (C) (1.5 foot). In this situation, the three lenses cover three completely different size areas.



When the three lenses are used to cover the same size area with the wide angle (B) closer to the subject at 4 feet than the standard (A) at 8 feet and the telephoto (C) at 15 feet, all three have the same depth of field at the same aperture.

Medium Format Depth of Field

If you switch from 35 mm to medium format you must be prepared for the fact that the medium format provides less depth of field. The decreased depth of field can best be explained by the difference in magnification between medium format and 35 mm. Let's take an example: when covering an area of about 120 mm (4.5 inches) with a 6 × 4.5 camera, the magnification is about .5×, with a depth of field of 6 mm. With a 35 mm camera, the magnification is only .3× providing a depth of field of 15 mm.

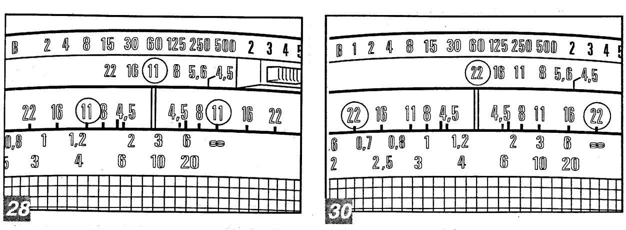
Setting the Lens for Depth of Field

When depth of field is unimportant, simply focus on the main subject, the eyes in a portrait, for example. But when you need a particular range of sharpness, you have to manipulate the focus and aperture settings. Focus at the closest subject that needs to be sharp and read the distance on the focusing scale. Then focus on the farthest subject and read the distance. Now try to set the aperture and focusing ring so the closest and farthest distances fall within the depth of field scale engraved on the lens.

If the range of distances is beyond the depth of field range even at the smallest aperture or at a usable aperture/shutter speed combination (for instance, at a shutter speed short enough for handheld work), you have to compromise. Decide whether it is more important to have the background or the foreground sharp or whether it is better for both to be beyond the depth of field range.

Hyperfocal Distance

If you want distant hills or mountains in sharp focus and, at the same time, you want to have the maximum depth of field, set the distance ring so that the infinity mark is opposite the depth of field indicator on the right. The lens is then set to what is known as the hyperfocal distance. The depth of field extends from infinity to half the hyperfocal distance. For example, if the 80 mm lens at *f*/22 is set that way, the 16-foot marking is opposite the index so the hyperfocal distance is 16 feet. The nearest point of sharp focus is 8 ft.



With the infinity mark opposite *f*/11 on the depth of field scale, the lens on the left is set for the hyperfocal distance corresponding to *f*/11. The hyperfocal distance (10 feet) can be found opposite the focusing index. The lens on the right is set at the hyperfocal distance corresponding to *f*/22

Evaluating Depth of Field on the Focusing Screen

Being able to see the depth of field is often mentioned as the main benefit of the SLR viewing system. Since depth of field is the range of acceptable sharpness based on a certain degree of enlargement, the above statement must be analyzed more carefully.

In the camera's viewing system, you are looking at a small image on a relatively small focusing screen even on a medium format camera. You are also viewing the image on a screen, which may not necessarily allow fine details to be seen. While you can see what is critically sharp and what is blurred, you cannot determine on this small image where sharpness is acceptable and where it is not acceptable on the final image. Stopping down the lens aperture in order to see the image at the set diaphragm opening makes the situation still worse as it reduces the image brightness. As a conclusion, don't try to determine depth of field on the focusing screen. Consult the depth of field scales.

INCREASING THE SHARPNESS RANGE

Depth of field is determined completely by the lens and lens aperture, and is based on the area coverage and the lens aperture. The range of sharpness in an image can be increased completely independent from the lens and lens aperture by a tilt control built into some medium format cameras. The camera must have a lens or a film plane that actually tilts in relation to the optical axis. Medium format cameras where the lens is combined with the camera body by means of a bellows may have this control. However, the degree of tilting is limited. One medium format camera, built like a large format camera, has tilt controls both in the lens and film plane. There are also special medium format camera models built for this purpose. The Hasselblad Flexbody is an example.

Use and Application of the Tilt Control

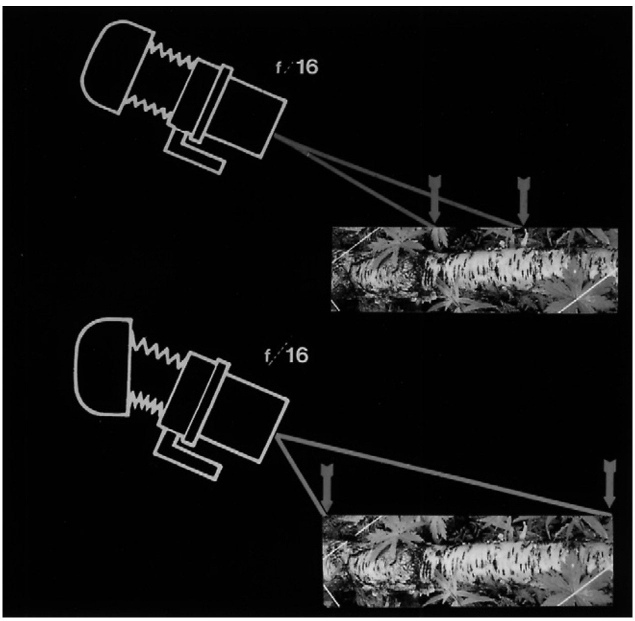
The technique of increasing the sharpness range is based on the Scheimpflug theory and can be applied whenever a subject is photographed from an oblique angle. When photographing a flat plane from an oblique angle, as may be the case in a tabletop setting, in a food illustration, but also in many landscape photographs such as a flowerbed or a meadow, the sharpness range can be controlled by tilting the image plane or the lens plane in relation to the other.

Large format photographers have used this control for years on their large format cameras. The maximum range of sharpness is achieved when a line extended from the image plane and a line extended from the lens plane meet at a common point on a line extended from the subject plane. With a flat plane, you can have practically unlimited sharpness from front to back while working at large lens apertures and consequently at short shutter speeds.

Regardless of which plane is tilted, you could align the camera by drawing imaginary lines downward from the front frame and the rear

frame, and tilt either or both until the lines meet at a common point on a plane extended from the subject plane. It is usually easier, faster, and more practical to make the adjustments by visually evaluating the image on the focusing screen.

Start by focusing the lens at a point about one third from the nearest point and two thirds from the farthest part of the subject that is to appear sharp. Tilt the film or lens plane in one direction and check whether the sharpness range increases. If not, tilt the plane in the other direction. Check the sharpness at the top and bottom, and see whether both become critically sharp. If not, change the focus setting on the lens. You will quickly find a point where you have sharpness over the entire plane.



Depth of field (top) is determined by the lens and lens aperture. The sharpness range can be increased without changing the lens aperture by tilting the image plane in relation to the lens plane (bottom).

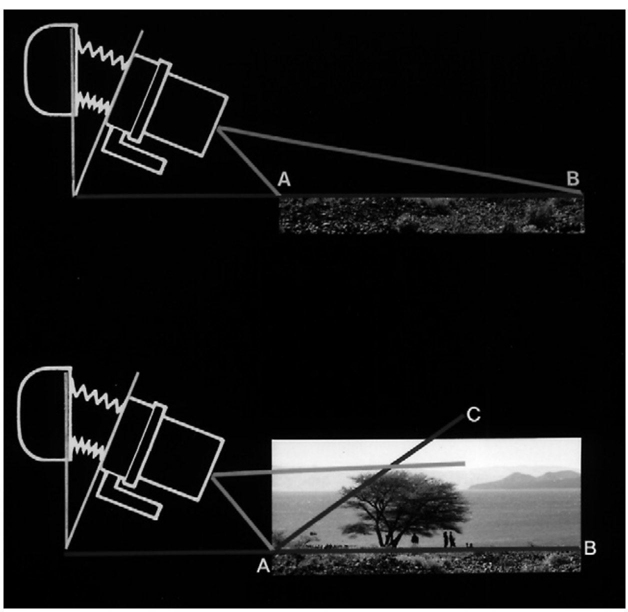
Lenses in Combination with Tilt Control

The covering power of the lens need not be greater than necessary to cover the image format if the tilting is done around the center of the image plane. That explains, for example, why the lenses designed to cover the 2 1/4 in. (6 × 6 cm) format can also be used on the Hasselblad Flexbody, and provide excellent corner sharpness and illumination regardless of how much the image plane is tilted. When tilting with the lens plane, you must have lenses with a covering power larger than the image format.

On medium format cameras, the tilt control is likely to be in one direction only—vertical. You must turn the camera for tilt control in the other direction.

Limitation in Sharpness Controls

Sharpness from front to back by tilting the image or lens plane can be achieved at any aperture when photographing a subject that is on a flat plane, as might be the case with documents, pictures laying on a flat table surface, or a flat field without trees. In such cases, you can accomplish excellent sharpness over the entire area even with the lens aperture wide open. If there are any three-dimensional subjects on the table, a cup and saucer, a vase with flowers, a loaf of bread, a bottle of wine, or a building or tree in a landscape, the various subjects are no longer on a flat plane. We have at least two different image planes—one is the table surface, or the flat landscape, the other going from the front of the table or landscape over the top of the various objects, the wine bottle, the flowers, the building, or tree. You can adjust the tilt for either one of these image planes, but not for both. The difference must be corrected with the lens aperture and its resulting depth of field. In such cases, tilting the image plane provides the sharpness in one plane. The aperture control on the lens is used to have sharpness in the other plane.



Sharpness can be obtained with the lens aperture wide open if the subject is on a flat plane A to B (top). With subjects going in the other direction, such as the tree (bottom), you can align the image plane for sharpness along A to B and close down the lens aperture to keep the top of tree within the depth of field, or align the image plane along A to C and control the sharpness to B again with the lens aperture.

The Tilt Control for Creative Purposes

The tilt control can also be used for limiting the sharpness range. In a commercial illustration, you can limit the sharpness to one specific product. In a bridal or portrait, you can limit it to the person or even part of the person with the rest of the image area blurred. Creating the blur by tilting the image or lens plane is especially helpful when the areas next to the subject are at the same distance, in which case the depth of field control does not work. Be careful, however, when using this technique. It is a special effect that can easily look artificial and attract unnecessary attention. Like any other special effect, don't overdo it to the point where it attracts attention.

CREATIVE USE OF LENS APERTURE

In many cases, the lens aperture may be set strictly for providing correct exposure. More often, it must be set for correct exposure, but also for providing the desired depth of field. Before you snap the shutter, you must decide whether everything from foreground to background should be sharp, or whether one or both should be blurred.

Many images look best or most satisfactory when they are sharp from front to back. This is especially the case with subjects with straight, sharp outlines such as the furnishings in a room, front steps on a row of houses, and rocks and boulders in a stream. Whether the subjects look better sharp or blurred must be the first consideration for selecting the depth of field range.

As a second consideration, you may want to keep in mind that images with everything sharp from foreground to background are the most ordinary ones because they represent the world as we see it. With our eyes, we see everything sharp because our eyes constantly and instantly focus on whatever we look at. Looking at images from this way, the lens aperture provides one of the most powerful means we have to make our photographic images look unique by concentrating sharpness on one narrow plane while keeping the rest of the image blurred. The aperture control is perhaps the greatest attention creating device we have. You can force your viewers where to look, most likely at the part of the image that is sharp. So think before you lose the effect by stopping the lens down to make everything sharp.

Background Sharpness

The lens aperture also determines the degree of unsharpness of subjects in front of and beyond the depth of field. It dictates how sharp or how blurred the background appears in the photograph. Since backgrounds form a large and important part of many images, your treatment of background sharpness must be an important consideration. Do not set apertures just for depth of field. Evaluate the image on the focusing screen at different apertures and check the degree of sharpness and unsharp-

ness within the entire image. Perhaps also check how different focal length lenses change the degree of sharpness and unsharpness.

As longer lenses magnify backgrounds, they can also magnify the blur. If you use a short focal length lens, your background may be just slightly out of focus. At the same diaphragm opening, but with a longer focal length lens, you can create a completely blurred background that forms a subdued, undisturbing backdrop behind the main subject.

Being able to see the image through the lens and at different lens apertures is the major benefit of the SLR camera.

Foreground Sharpness

What has been said about backgrounds also applies to foregrounds. In some cases, you may want to include completely blurred foreground objects just to add a touch of color to a scene or to enhance the three-dimensional aspect. Out-of-focus foregrounds are generally best when blurred completely so that they are not even recognizable. If blurred just a little, the blurry foreground might look like a mistake. A longer focal length lens can be very helpful to make these foreground subjects nothing but a patch of diffused colors. Suitable objects for blurred foregrounds can be found almost everywhere outdoors. The blurred foreground approach usually does not work in black-and-white.

Manual Stop Down Control

While the focusing screen in an SLR camera is not usable for determining the depth of field, it can beautifully show the amount of sharpness or unsharpness in background and foreground areas, and how the degree of sharpness changes as the lens aperture is opened or closed. The SLR finder is excellent for evaluating the effectiveness of the image and should be used for that purpose in combination with the manual aperture stop down control.

On SLR cameras, the lens aperture is always fully open to provide the brightest image on the focusing screen. The image you normally see on the screen is with the lens aperture fully open. With the manual stop down control you can see what the image looks like at any aperture setting so you can determine which aperture provides the desired or the best results. A manual stop down control must be part of every lens or camera used for serious photography.

A medium format camera has an advantage over 35 mm with the larger focusing screen perhaps providing better and more effective image evaluation with the aperture wide open or closed down. With a square format camera, you have the additional benefit of viewing the image on the screen from different angles with different finders. Using a standard focusing hood, you can even evaluate the image with both eyes open as you evaluate the image on a large format camera.

ACTION AND SHUTTER SPEED

The shutter speed may be pre-determined by exposure or by your need for handheld camera operation. The speeds that can be chosen with reasonable assurance of sharpness in handheld photography depend on the focal length of the lens and one's ability to hold the camera steady. A fairly safe rule is to use a shutter speed fraction not longer than the focal length of the lens. A 60 mm lens is satisfactory at 1/60 second or shorter; a 250 mm lens is preferably used only at speeds of 1/250 second or shorter. You may be able to use slower shutter speeds, but I suggest being careful before doing so with today's sharp films.

When you are photographing moving subjects, the shutter speed must also be chosen from the image creating point of view. You must decide whether the motion is to be frozen, recorded with a little blur, or completely blurred.

A short shutter speed of 1/2000 almost freezes the fast moving water and shows it in our photograph more or less as we see it with our eyes

A slow shutter speed of 1/4 second records the water with a blur, which is different from the way we see it with our eyes.

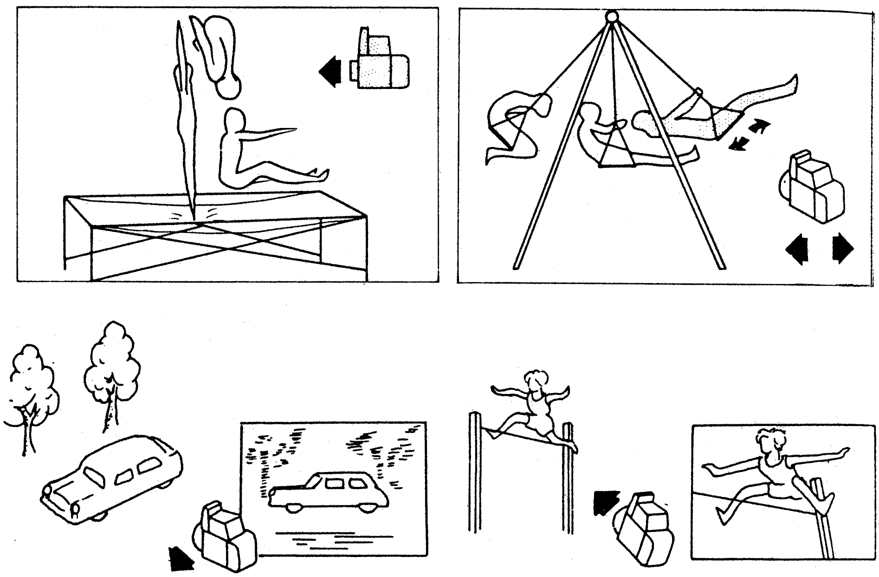
Freezing Action

A moving subject recorded with a high shutter speed appears to be standing still. The shutter speed necessary to stop action depends on the speed of the moving subject, but also on the magnification of the subject as recorded in the camera. If the moving subject fills the entire frame, its image moves farther across the image plane in a given time than it would if it were to fill only half the frame.

The amount of movement in the image also depends on the angle at which the subject is photographed. The image moves the greatest distance when you record it from the side as it moves across the picture. It moves relatively little when you record it from the front as it moves toward or away from the camera. Between these limits, the movement

varies. If you change the camera angle to 45° or to straight on, you can stop action in a way that would not be possible from the side.

Another way to stop some motions is to photograph the subject at the peak of the action. This works well with all sports or actions that are not continuous, but have a beginning and end or are repeated. In golf or tennis, shoot at the end of the stroke; with a person on a swing, shoot at the maximum height as he or she changes direction. There is a peak of action on many rides in amusement parks, in jumping on a trampoline, in ballet dancing, and in other stage and circus performances. If such actions are caught at their peak, a shutter speed of 1/500 second is more than sufficient for stopping action with most lenses. To stop continuous motions, such as those of skiers, motorcycles, cars, horse races, divers, and roller coasters, 1/2000 second may be necessary.



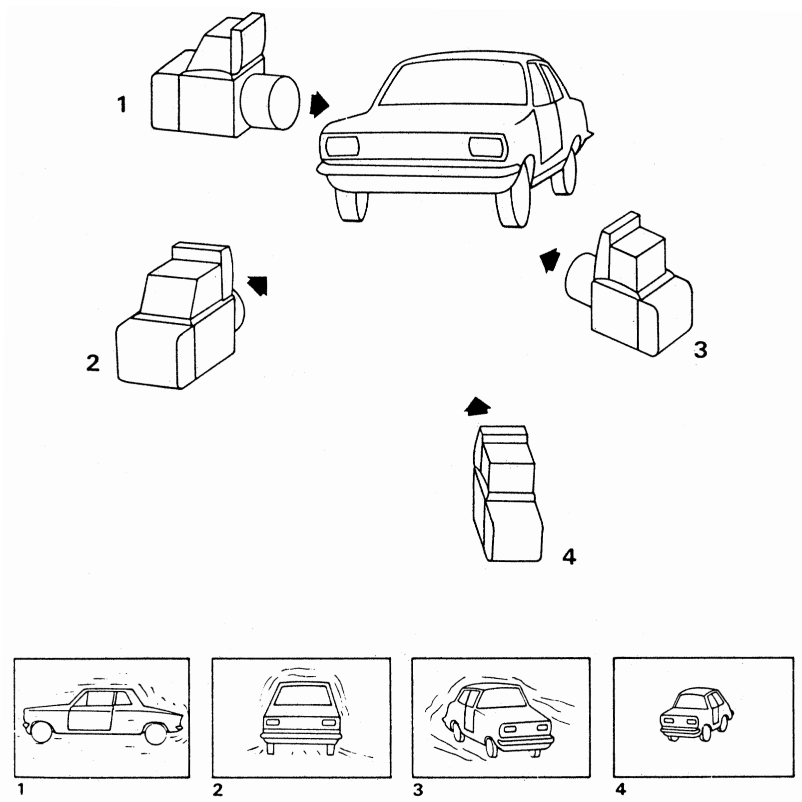
Blur can be reduced by photographing moving subjects when the subject is momentarily still—for example, at the end of a swing or at the top of the bounce from a trampoline. Another method is to follow the movement of the subject with the camera, releasing the shutter while the camera is moving. The subject appears sharp against a blurred background.

Blurred Motion Effects

Shutter speed is one of the greatest creative tools available in photography. It is a tool that allows you to record on film any moving element in an unusual way. The eye cannot blur movement, which is why blurred motion effects are fascinating and attract attention.

The feeling of motion can be visually conveyed in a still photograph by recording any moving subject partially or completely blurred. The approach is not limited to the well known applications such as rides in amusement parks, racing cars, and football games, but is often more interesting with more common subjects such as reflections, clouds, smoke, wind blown trees, flowers, grass, and rain.

It is not easy to see how much blur is created in the camera. A focusing screen evaluation can help, even though you cannot see the amount of blur. The best approach is making a test on instant film. If this is not possible, photograph the subject not only at the speed that you calculate, but also at two slower and two faster shutter speeds. Keep a record of the shutter speeds for future reference.



The amount of blur is greatest when the subject is moving at a right angle to the camera view (1). A subject moving at the same speed straight toward the camera (2) or at an angle (3) is less blurred. There is less blur when the image of the subject is smaller even if taken at the same shutter speed (4).

Following Moving Subjects

You can also follow a moving subject with the camera and trip the shutter while the camera is moving. This approach offers many different possibilities. If you move the camera at the same speed as the subject, only the background is blurred. The amount of blur depends on the shutter speed and focal length of the lens.

You can also move the camera slower or faster than the subject, creating a blur in the background and in the subject. With many subjects, some elements are moving in different directions and at different speeds, for instance, the spokes of a wheel, the legs of a bicycle rider or horse, the wings of a bird, and the arms of a ballet dancer or ice skater. So even if you move the camera at the same speed as the subject, some elements may still be blurred, in addition to the background, which further enhances the impression of motion.

Because the desired effect in the image is frequently a personal choice, it is difficult to give recommended shutter speeds for photographing moving subjects or with a moving camera. But for a basic idea, start with around 1/8 second for a bicycle rider or runner.

Choice of background is important. With a completely plain background, such as blue sky, an empty wall, or a dark theater set, camera movement is not noticeable. To bring out the feeling of motion, the streaking effect must be obvious. So choose subjects with highlights and bright areas, and select a contrasting background, such as trees against the sky, sunlight on water, or crowds of spectators.

Camera Use for Following Moving Subjects

Cameras can be moved handheld or on a tripod. Many photographers find it easier to follow their subject with a handheld camera, especially when the subject changes speed or directions, as birds or ice hockey players do. If the subject, on the other hand, moves along in a straight line—such as a racing car, an athlete in a 100-meter sprint, a bicycle rider on a straight road, or an object falling to the ground—a tripod-mounted camera is more likely to produce successful results.

Looking straight down on the focusing screen with the regular focusing or magnifying hood cannot be recommended for motion photography, mainly because left and right are reversed. You are likely to move the camera in the wrong direction. Prism viewfinders reverse the image. Many photographers find sports and frame viewfinders, if available, the best choice for motion photography.

CHAPTER 10

Creating the Image in the Viewfinder

The medium format image is only as good as the view through the finder. The type of finder and your method of viewing, framing, and focusing are important elements for creating the image.

OPTICAL VIEWFINDERS

On most nonreflex cameras—the rangefinder, press, and special wide angle types—the finder is a permanent part of the camera body, and you have no choice of viewing from different angles. This is not necessarily a disadvantage. These finders are usually well designed and serve their purpose for composing the image. A split image rangefinder may be part of the finder so it can also be used for focusing.

These optical finders have their own advantage. The image appears as bright as you see the scene with your eyes. There is no lens, mirror, and focusing screen to reduce the light. On the other hand, these finders show only the area coverage, so you have no idea of how the image will be recorded in the camera.

Parallax

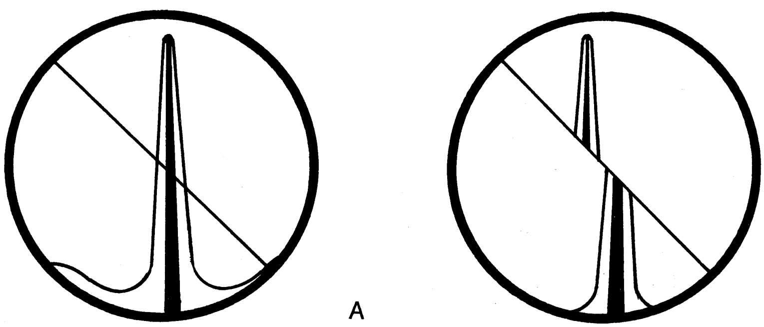
Optical viewfinders are adjusted at the factory so that their field of view corresponds to that covered by the lens at the longer distances, where such cameras are usually used. Since the finder is located above or to the side of the camera lens, at closer distances, it sees the subject from

a slightly different point of view than does the lens. This creates a problem known as *parallax*. Parallax is a concern only when you are photographing at close distances. Parallax must also be considered with TLR cameras. Some viewfinders may have a line in the viewfinder indicating the part of the scene that may be cut off at close distances.

RANGEFINDER FOCUSING

In rangefinder focusing, you view the subject through two windows, on the left and right of the camera body. Each window views a somewhat different area, so you can see a double image over the entire field, or, in the case of a split image rangefinder, the two images are separated along a split image area. A horizontal or vertical line appears split when the lens is not focused properly. Turning the focusing ring brings the images together. When the line appears unsplit, or you only see one image, the lens is focused on that subject.

Split image rangefinder focusing is accurate because you can easily see whether a line is split or continuous. It is also rather reliable because even a user with impaired eyesight can usually see whether the line is split or continuous. This is one of the reasons why many SLR users like focusing screens that also offer split image rangefinder focusing.



A B

Accurate focusing with a split image rangefinder is obtained when a straight line in the subject crossing the split is continuous (A), not broken (B). The split line can be horizontal, vertical, or diagonal.

AUTOMATIC FOCUSING

A good automatic focusing system provides amazingly good results at least for casual work as has been proven in 35 mm, and point and shoot cameras for some time. This feature is now also appearing in the medium format and can have the same benefits as it does in other cameras. For candid photography when you may have no time for focusing manually, or for sports and action photography where subjects move and change distances, the automatic focusing has your camera ready for

shooting at any given moment. Automatic focusing can also be helpful in more serious applications if it is properly designed.

An automatic focusing system for serious and professional work must offer the option of manual focusing or, even better, has what is known as a single focus mode that lets you focus at the part of the subject of your choice, then locks the focus so you can recompose without a change in the focus setting.

The single focusing mode is essential in serious photography since you, the photographer, not the camera, have to decide on what part of the subject or scene the lens must be focused—the approach that you undoubtedly use now for serious work without automatic focusing cameras. In these cases, the automatic focusing feature is used for nothing more than turning the focusing ring instead of doing it manually.

The single focus mode or manual focusing mode must be available to the photographer also because in many other situations, the focus setting is not based on a specific part of a subject but based on the desired depth of field. The automatic focusing feature is then used to measure the minimum and maximum distances of the desired sharpness range. The final setting must be made manually.

The continuous focusing mode where the focus changes continually as the camera or the subject moves is helpful or necessary for candid work and when photographing moving subjects. Automatic focusing combined with a signal in the viewfinder that indicates when proper focus is achieved also has benefits for photographers who are having problems seeing on the focusing screen when the lens is focused accurately. The signal indicates proper focus.

FOCUSING SCREENS

SLR and TLR cameras are equipped with focusing screens. Most modern medium format SLR and TLR cameras allow you to select the type of screen and change from one screen to another at any time. Focusing screens can be made from glass or plastic.

Most focusing screens are combined with a Fresnel brightener, which bends the light rays so most of them from any part of the focusing screen go through the center of the eyepiece. The Fresnel lens brightens the corners of the viewing area.

The choice of screen must be a personal one. Do not purchase one specific screen simply because someone else uses or recommends it. If at all possible, check the different screens to determine which is best for your eyesight and for the lighting conditions, the lenses, and the accessories you use most of the time. For any camera, you certainly want to look for a screen that provides a bright image.

Screen Brightness

While a bright screen is great for seeing and composing the image, it does not necessarily provide faster or more accurate focusing. For this

purpose, you need a focusing screen that provides an image in which fine details and fine lines are seen with the utmost sharpness and contrast. Consider this point seriously because accurate focusing is still the main reason and main advantage for ground-glass focusing. When comparing different screens, compare not only the brightness, but the focusing accuracy as well.

The overall matte surface of the older ground-glass screens dims image brightness. New technology has resulted in focusing screens that are noticeably brighter than their predecessors. Most medium format cameras are equipped with such screens today. If you have an older screen, consider seriously moving up to a more modern type if the screens are interchangeable. The great improvement in brightness justifies the higher cost.

Plain Focusing Screens

The plain focusing screen is considered the most satisfactory by many photographers. It provides an image that, with the exception of perhaps some fine black marks for centering, is uninterrupted by circles and clear areas, making it the best choice for evaluating the effectiveness of the image.

On the other hand, seeing whether the image formed by the lens falls accurately in the plane of the screen is not as easy with a plain screen as it is with other types. For this reason, some photographers prefer screens with microprisms and split image rangefinders.

Focusing Screens with Split Image Rangefinder

A focusing screen with a split image rangefinder in the center area is available for many medium format cameras. The split can be horizontal, vertical, or diagonal. In a square format camera, the screen can be inserted so the split is either horizontal or vertical.

The image can be focused either in the clear split image center circle or on the surrounding focusing screen area. For split image rangefinder focusing, the center area must be aimed at the main subject or at a straight line at the same distance that crosses the split image area, perhaps an inconvenience in some situations where you to have to work fast. When the straight line crossing the rangefinder area is continuous, the focus setting is correct.

The main limitation of the split image screen involves lenses. When the aperture of the lens is smaller than about $f/4$, one of the two halves of the split image field blacks out. You cannot focus with the rangefinder. A focusing screen with split image rangefinder should not be considered if you use $f/5.6$ or $f/8$ lenses extensively.

With $f/4$ or faster lenses, both fields within the rangefinder area are clear only when your eye is in the optical axis. If one of the fields is blacked out, move your eye slightly up or down, or sideways.

Focusing Screens with Microprism

Such screens have a large bright microprism focusing area in the center of the screen.

As the name indicates, the center area consists of many tiny prisms that shatter the image, making the image blurred when the lens is not focused properly. The image blurs more quickly than the image on the overall focusing screen field. The image within the microprism area seems to jump more readily and rapidly into place than it does on the other areas of the focusing screen—at least on older focusing screens. Some of the latest screens, the Acute Matte type for example, I feel provide an image over the entire screen surface that is practically as sharp as a microprism and makes the image jump in and out of focus as clearly and as rapidly as it does within the microprism area and therefore makes the need for a special microprism screen unnecessary.

Screens with microprism centers can be used with lenses of all focal lengths but also have limitations in relation to the lens aperture.

Clear Glass Screens

A clear glass screen, if available for your camera, can be recommended only for special applications when photographing through a telescope or in photomicroscopy where accurate focusing of fine detail in a specimen is difficult with another type of screen.

Screens with Grid Patterns

These screens, also called *checked screens*, have vertical and horizontal guiding lines, which are helpful when the subject lines have to be parallel to the edges of the image, as in architectural photography or in aligning flat art for copying.

Other screens or screen masks for square format cameras may provide guiding lines to show the vertical and horizontal 8×10 in. paper proportions. Such screens should be used by photographers who plan to change square images into rectangles.

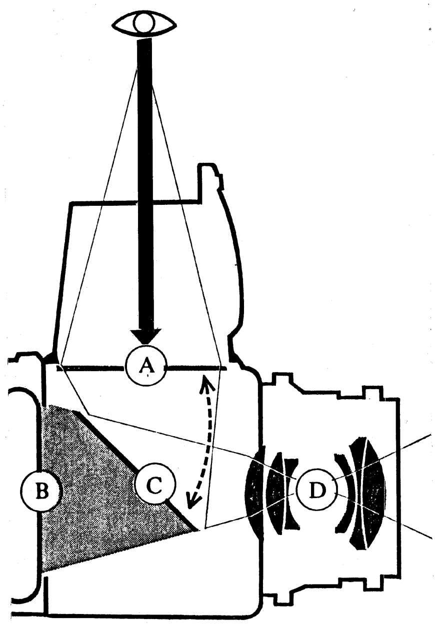
To make the rectangular image proportions more pronounced while viewing, you can darken the four corners with black lacquer or cover them with a gray filter foil.

Cleaning Focusing Screens

Lens cleaning fluids or other chemicals must never be used on plastic screens or glass screens combined with a Fresnel lens. Since screens rarely get finger or grease marks, you usually need to do nothing more than brush or blow dust away. Wipe a screen only if absolutely necessary, and if you do, do so very gently with a soft cloth, perhaps slightly moistened with water or a mild soap and water.

VIEWFINDERS

The purpose of a viewfinder on an SLR camera is to magnify the image on the focusing screen for accurate focusing and to shield the screen from extraneous light. In handheld photography, the viewfinder can also help in improving camera steadiness.



The purpose of a viewfinder on an SLR camera is to give the photographer a sharp and magnified image of the focusing screen (A) regardless of what the photographer's eyesight might be.

Viewfinders for Improving Camera Steadiness

For handheld photography, select a finder that allows for steady and convenient holding of the camera. Finders that help you in this respect can be regular focusing hoods for viewing from above or prism finders for 90° or 45° viewing. A finder equipped with a large comfortable rubber eyepiece that can be pressed firmly against the eye is recommended. A firm contact between the finder eyepiece and the eye is of utmost importance for accomplishing camera steadiness.

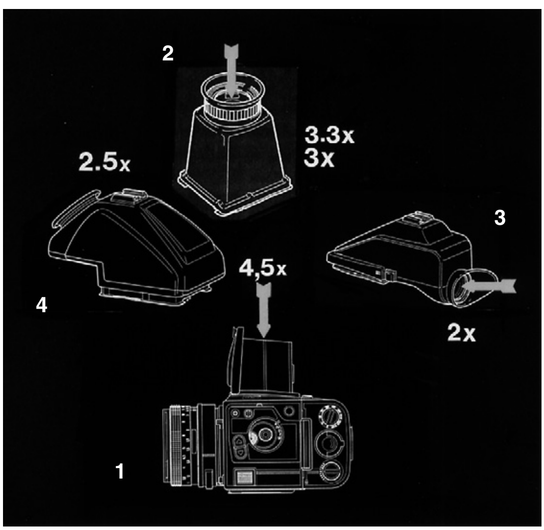
The firm contact between the eye and the finder is lost when you wear eyeglasses, as they prevent you from pressing the camera against the eyeglasses as hard as you do directly against the eye. Light may also enter between the eye and your eyeglasses, flaring the screen and reducing the apparent brightness. On older viewfinders, eyeglasses may also prevent you from seeing the entire focusing screen area. Most new viewfinders are equipped with high eyepoint eyepieces, which eliminate this problem but do not improve camera steadiness.

For handheld photography, I still suggest that you try finding a way to view without eyeglasses. On many medium format cameras, the viewfinder can be matched to your eyesight either with a built in diopter correction, with correction lenses, or with different eyepieces with different diopter power. Check with the manufacturer. Having the correction built into the viewfinder probably means having to remove the eyeglasses when taking a picture. (I have to do so since I need reading glasses to read the figures on the camera and lens in dim light.) Put the glasses on a chain or string so you can simply drop them for taking a picture.

Film Format and Viewfinder

A medium format camera designed for the square format or a 6 × 7 cm camera with a rotatable film magazine offers a wide choice of viewing. Since the camera never needs to be turned, the focusing screen image can be viewed straight down with a waist-level finder, or a magnifying hood, or with prism viewfinders that allow viewing from a 45° or a 90° angle. This is obviously an advantage for anyone interested in photographing subjects from different camera angles. For handheld photography, one is as good as the other so the choice should be mainly based on the preferred way of holding the camera. When working with a tripod, a prism finder is necessary or at least recommended.

A camera made for a rectangular format without a rotating film back needs to be used with a 90° prism finder. The 90° finder offers the only practical way of viewing when such a camera is turned for verticals. The choice of finder is practically eliminated



The choice of finder for square format SLR cameras may include the foldable waist-level type (1), a magnifying finder (2), both for viewing from the top as well as prism viewfinders for eye level (3) and 45° (4) viewing. A high magnification helps in precise focusing.

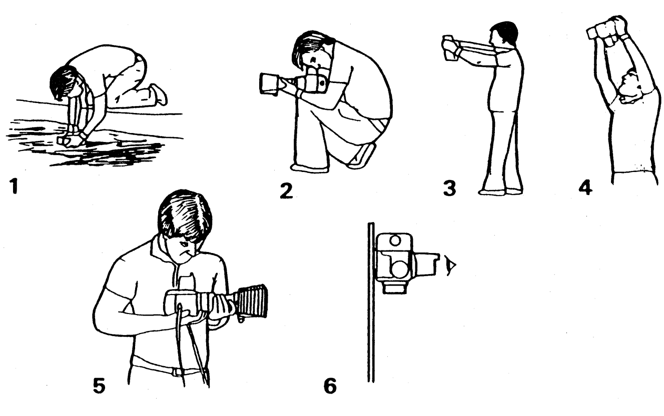
Prism Versus Waist-Level Finders

The folding hood viewfinder, that usually comes with square format cameras is the simplest, lightest, and least expensive interchangeable viewfinder. Such a finder adds practically no weight to the camera. When folded down, the camera is compact, and the focusing screen is protected from dirt and damage. You may find, in addition, that such a finder has a higher magnification than the prism finders offered for the same camera.

A folding-type finder, often called a waist-level finder, need not and should not be used from the waist level unless it is desired to photograph the subject from that angle of view. For normal viewing, it is best pressed against the eye like a prism finder, especially for handheld shooting. The lens is then only about 2 inches lower than it would be with a prism finder, and convenient, handheld photography from eye level is possible. With a folding hood viewfinder, you can also view the image on the screen directly without the magnifying lens, and you can view it with both eyes open, if desired. This direct viewing approach offers the greatest flexibility in viewing from many different angles. You can turn the camera sideways, place it on your knee or on the ground, or point it straight downward or upward. The camera need not be in front of your eye.

Magnifying hoods also allow viewing from the top, but they do not fold up. They are equipped with a magnifying eyepiece that may have a built in diopter correction.

When viewing from the top without a prism, right is left and left is right. This consideration is unimportant in general photography. You get used to it quickly and are hardly aware of the reversed image. But it becomes objectionable when you are photographing moving subjects. You'll probably turn the camera the wrong way and miss the shot. With a prism finder, the image is not only right side up, but also laterally correct—so what is left is left, and what is right is right.



Viewing from the top has great advantages when taking photographs from low angles (1), placing the camera on the knee for additional steadiness (2), photographing straight down (3) or from over the head (4), photographing sideways in candid work (5), or with a vertically mounted camera (6).

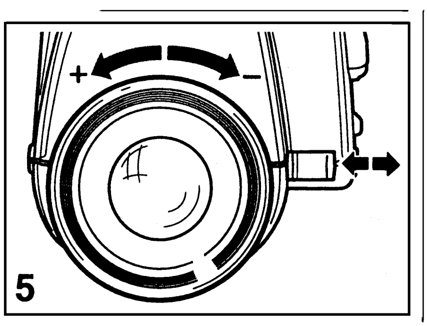
Prism Viewfinders

A prism viewfinder with either 45° or 90° viewing adds some bulk and weight to the camera and costs more than the folding type, especially if it is made with prisms, not mirrors. A finder made with a prism is more rugged than one using a mirror and is likely to give better image quality. A prism viewfinder may be made with a built-in light meter, which by itself can be a good reason for adding it to a medium format camera.

For tripod work, a prism finder is a definite advantage because it allows you to put the tripod on a higher level.

Matching a Viewfinder to Your Eyes

Besides convenient image evaluation, a finder must quickly show exactly when the lens is set at the correct distance. This means that you need to see a sharp image of the focusing screen. As we get older, our eyes no longer adjust to all distances, and they may no longer be able to adjust to the finder's viewing distance. As a result, you may not be able to see whether the image on the focusing screen is really sharp. You may not see the image jumping in and out of focus when you turn the focusing ring, and it may take you a long time to focus a lens. If you have this problem, the camera viewfinder probably needs to be matched to your eyesight. Fortunately, this is possible today on most of the better cameras. Check with the manufacturer.



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Many viewfinders have eyepieces that can be rotated or adjusted for different diopter powers. The adjusted setting should be locked. In this case, it is locked with the lever on the right.

When you adjust an eyepiece or select the proper correction for your viewfinder, keep in mind that the finder is to produce a sharp image of the focusing screen—not the subject in front of the lens. The adjustment or selection is best made without a lens on the camera. Point the camera without the lens at a bright area and turn the diopter adjusting ring, or switch to different correction lenses until the focusing screen or the engraved lines on the screen appear absolutely sharp.

After adjusting, take your eye away from the finder, view a subject at infinity, and recheck the adjustment once more to see if it still produces a sharp image. Looking at infinity in between ensures that the eyepiece is adjusted for a relaxed eye. You need do this diopter adjustment only once. If possible, lock the adjustment. You should not change the setting when switching lenses or taking pictures at different distances.

Before you make the above adjustment or decide on the proper correction lens, you must decide whether you want to view with or without your eyeglasses, and then select the correction for whichever method you decide.

Diopter correction lenses or eyepieces are not corrected for astigmatism. In most cases, such correction is not necessary. Only in severe cases may it be necessary, and if so you need a special lens ground to the proper diameter by an optician.

Cleaning Viewfinders

The magnifying lenses or eyepieces of your viewfinder are in an exposed position, and grains of sand and dust can accumulate in the hood crevices. Blow and brush away all dust particles before wiping with lens tissue and, if necessary, applying lens cleaner.

The same approach can be used on the exposed bottom surface of prism finders unless the manufacturer advises against it. Clean, and especially wipe, lens or prism surfaces only when absolutely necessary. A prism viewfinder that is not attached to the camera should always be protected with the cover that slides over the bottom plate and usually comes with the prism finder.

IMAGE EVALUATION

Seeing the Image as It is Recorded in the Camera

SLR cameras offer the great advantage of allowing you to see the image as it will be recorded in the camera, at least in most respects. You cannot see the results obtained with different shutter speeds or the lighting ratio between flash and daylight, for example. Furthermore, you can only see the image as it is recorded in the camera if you do not forget to operate one of the important controls on the camera or lens—the manual stop down or preview lever found on most medium format SLR cameras.

On SLR cameras, the lens aperture is always wide open to provide the brightest focusing screen image for framing and focusing. The image you normally see is thus the image as it will be recorded in the camera with the lens wide open. If the picture is made at any smaller aperture, depth of field, foreground and background sharpness will be different. Since the aperture determines to a great extent what the final image looks like, and is one of the most important controls for creating images and making them different, you must use the manual stop down control in serious photography. You can see how the image, foreground, and background sharpness change by closing and opening the aperture,

allowing you to determine visually which aperture creates the most effective image.

Evaluating the image with the lens closed down is essential when you use special effect devices in front of the lens. With vignettes, the sharpness of the outline and the size of the cutout in the vignette change with the aperture. With partial filters, the dividing line between the filtered and nonfiltered area shifts. On some diffusion devices and soft focus lenses different degrees of softness are produced at different apertures.

Frame and Sports Viewfinders

Some medium format cameras provide the option of viewing through sports or frame viewfinders. They may be separate accessories, which are attached to the camera body, the lens, or the lens shade, or they may be built into the folding hood viewfinder. Such finders allow you to see the covered area with the mirror in an SLR camera lifted up.

Such finders may allow you to see what exists and what is happening outside the photographed area. When panning with the camera, you can see where the camera is moving to, how far to move it, and when to press the release. A frame finder with crosshairs makes it easy to follow a moving subject.

LEVELING THE CAMERA

In some types of photography, architectural work, copying, and some commercial and industrial applications, it is important to have the camera perfectly perpendicular to the subject—meaning that the image plane must be parallel to the subject. A focusing screen with a grid pattern (a checked screen) can help, especially on a medium format camera. The image on the focusing screen is sufficiently large enough to align the subject's horizontals or verticals with the grid lines on the screen.

A spirit level can be more precise in assuring that the image plane is parallel to a vertical subject (for example, a building). If the camera does not have a built-in spirit level, you might find it as an accessory to be attached to the camera body or perhaps built into a tripod coupling.

IMAGE COMPOSITION

The effectiveness of every image can be enhanced by good composition, which means an effective arrangement of lines, shapes, and colors within the image area. Regardless of what camera and viewing system you use for your medium format photography, you must try to arrange the subject elements within the outlines of the finder so they form a well-composed image. The focusing screen of an SLR camera must be considered a better choice for composing and evaluating the composition than an optical type finder.

It is also recognized that most photographers seem to pay more attention, are more careful, and spend more time evaluating the image and the composition on the medium format focusing screen than they do on a 35 mm SLR camera. This seems to come automatically.

Working in the medium format might, therefore, automatically make you a more careful photographer.

Books on composition are readily available and recommended. The information in these books is helpful to any photographer working in any field of photography. When studying these books, however, be aware that compositional principles are not rules that must be followed every time you take a picture. Photography is only partially a science; it is more a form of art and personal expression. The principles are guidelines that usually contribute to producing a well-balanced image. The principles can be broken if your intent is to do something different or to do something that attracts special attention. You always attract attention with images that are out of the ordinary and different from the way we usually see things.

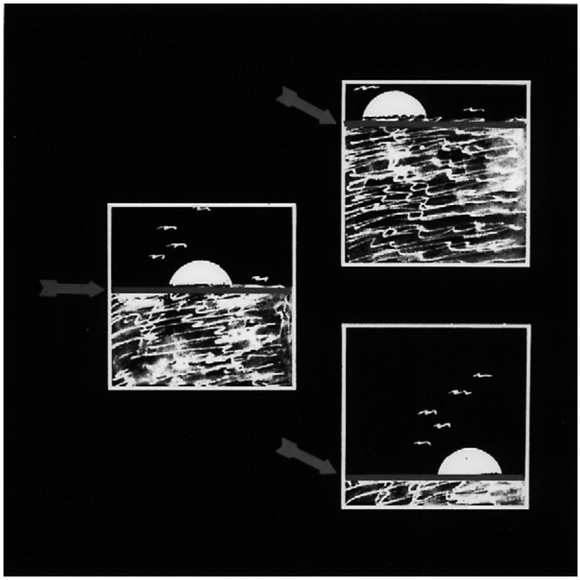
Composition involves more than the effective arrangement of picture elements. A picture must be free from distracting elements of any kind. An element can be more or less distracting, depending on the degree of sharpness. That is where the benefits of the SLR focusing screen can be most beneficial since the degree of sharpness depends on the lens aperture. A highlight as a small point may be hardly noticed with our eyes, but may be distracting when seen through the lens as a large blurred circle. Always examine the composition around all four sides to be certain that no important lines or subjects are cut by the frame of the image. The cutting point attracts the eye and may even make the eye move out of the picture, something that must never happen to a photographic image.

Composition in Different Film Formats

The principles of composition are usually discussed in relation to the rectangular image format—the format of the enlarging papers. However, whatever is discussed on composition probably applies to any image format—horizontal or vertical rectangles, square formats, and even panoramics. The recommended placement of a main subject in rectangular, square, and panoramic photographs is approximately 1/3 from the left or right, and 1/3 from the top or bottom. The need for balancing the main subject in some way applies to all and so does the need for eliminating distracting elements. There is nothing new to learn as far as composition is concerned if you move, for example, from the rectangular 35 mm format to the square medium format.

While each subject or scene may call for a specific image format, I also feel that practically any subject can be composed effectively in the square, if only because the square is a beautiful compromise between the vertical and the horizontal. The statement I hear occasionally that a full length photograph of a bride and groom has to be vertical and a group photograph of the bridal party has to be horizontal makes no

sense to me. Either one of the shots could be vertical or horizontal if other picture elements are part of the image, and certainly both could make beautiful squares by making foreground and background elements part of the composition.



In any image format, a strong vertical or horizontal, such as the horizon, crossing the image in the center has a tendency to split the image into two equal halves. A more effective positioning in any format is usually closer to the top or bottom, depending which part of the image is more important.

Compositional Advantages of the Square Format

For location portrait, wedding, celebrity, and fashion pictures, the square format offers the wonderful advantage of including more of the background area without reducing the size of the people. This can make location portraits much more effective. Location portraits are more than just pictures of people. They should be images of people in a surrounding area. Therefore, the background becomes an important part of the image. The square format allows the photographer to include more of that background area on the left and right and, by doing so, enhance the look of a true location portrait.

As a wedding photographer, keep in mind that square prints in a wedding album can look absolutely striking. This is true especially for the 10 × 10 in. size. The photographs look so much larger than the ordinary 8 × 10 in. size. So, before you ask your lab to make rectangular prints from your square negatives, consider supplying square prints to your bride.

The square format allows the photographer to include more of the background area on the left and right, enhancing location portraits and giving them the true location look.

Square negatives sent to a laboratory for producing rectangular prints should be accompanied by the proper cropping instructions. Many laboratories supply masks for that purpose. However, if you compose the subject to fit into the proper guidelines on the focusing screen, the laboratory can simply print the center area. No special cropping instructions, except to specify a vertical or horizontal or square, are needed.

CHAPTER 11

Exposure and Metering Modes

Exposure is determined by the amount of light, the sensitivity of the film or electronic chip, lens aperture, and shutter speed, which must be adjusted so that the proper amount of light reaches the image plane in the camera.

LENS APERTURE

The aperture ring opens and closes the diaphragm built into each lens. The size of the diaphragm opening is engraved on the lens in *f* stops or *f* numbers. A large opening, letting more light onto the image plane, is indicated by a small number, such as *f*/2.8. A small opening letting less light through the lens is a high number, such as *f*/16. On some lenses, especially those made in Europe, the aperture is engraved as a ratio; 1:4 means *f*/4. The *f* number is the ratio between the diameter of the entrance pupil and the focal length of the lens. A 150 mm lens is *f*/4 because the entrance pupil is 37.5 mm in diameter ($150 \div 37.5 = 4$).

Aperture numbers are multiples of 1.41 (for example, $f/4 = f/2.8 \times 1.41$, $f/22 = f/16 \times 1.41$) because 1.41 is the square root of 2. Light intensity increases or decreases in the proportion of the square root of 2. The *f* numbers work in the same way.

A change in aperture from one figure to the next doubles or halves the amount of light going through the lens. The amount of light doubles when you move the setting to the next lower number (from *f*/5.6 to *f*/4); it is reduced by half when you go to the next higher setting number (to *f*/16 from *f*/11).

The maximum aperture of a lens is frequently referred to as the speed of the lens, and large aperture lenses are known as fast lenses. (A large aperture means more speed.)

SHUTTER SPEED

Shutters, focal plane or leaf type, control the length of time the light coming through the lens shines on the image plane. Aperture and shutter speed together, therefore, determine the total amount of light that forms the image. The same amount of light can reach the image plane with many different combinations of aperture and shutter speed. As aperture numbers double or halve the amount of light, it is easy to compensate for these changes by adjusting shutter speed.

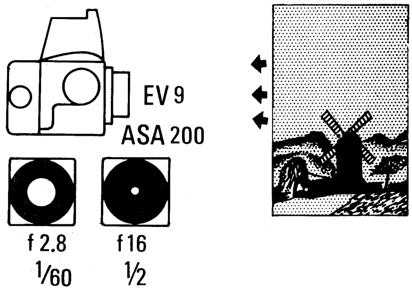
If the aperture is closed one number (from *f*/4 to *f*/5.6, for example), only half the amount of light passes through the opening. If this amount of light passes through the opening for twice as long—the shutter speed is changed from 1/250 second to 1/125 second—the exposure is the same. If the aperture is opened one number (from *f*/16 to *f*/11) the shutter speed must be shortened (set to 1/30 second from 1/15 second) to achieve the same exposure.

EXPOSURE VALUES

Some camera lenses and most exposure meters also have an exposure value scale (EVS) in addition to aperture and shutter speed. Exposure values (EV) were established some time ago by camera and meter manufacturers as a single figure to indicate how much light exists. The EV reading at a given light level depends on the sensitivity of the film in the camera because you set the meter for the film speed prior to taking the meter reading. If the EV is 12 for 100 ASA film, it will be 14 for 400 ASA.

The exposure value system in some ways offers simplicity. It is easy to remember a single number and to transfer this single number from the meter to the lens or from one lens to another. It is also a simple way to remember the exposure values for a particular film when used in standard lighting conditions.

The greatest benefits of EV, however, are derived when aperture and shutter speed rings on the lens are coupled. Once such a lens is set to the EV, any of the aperture and shutter speed combinations of the coupled rings will give you a correct exposure. In a way, coupled aperture and shutter speed rings offer the same automation found on built-in meters. If you change shutter speed from 1/30 to 1/125 second, the aperture changes automatically, say from *f*/8 to *f*/4. If the lens is set to 1/500 at *f*/2.8 and you want *f*/8, turn the aperture ring three notches, and the speed will automatically be set to 1/60 second.



Exposure values (EV) are single numbers indicating the amount of available light based on the sensitivity of the film. Various aperture and shutter speed combinations will give the correct exposure for a specific EV value—for example, *f*/2.8 and 1/60 second or *f*/16 and 1/2 second.

FILM SENSITIVITY

The lens settings always depend on the sensitivity of the film. If you use a meter, separate or built into the camera, the film sensitivity must be set on the meter before you make a reading. The sensitivity, also called speed of film, is usually indicated in two ways; DIN (the German standard) and ASA, or now ISO, the international standard. ASA and ISO numbers are identical: 40 ASA = 40 ISO.

A film that has double the ISO or ASA as another film is twice as fast. Close the aperture one *f* stop to compensate for the difference. If 100 ISO or ASA requires *f*/5.6, *f*/8 will give the same exposure on 200 ISO or ASA. In the DIN system, a film twice as sensitive has a DIN number that is three numbers higher. DIN 24 requires *f*/8 if *f*/5.6 is correct for DIN 21.

DETERMINING LENS SETTINGS

Estimating Lens Settings

Some seasoned photographers, especially those frequently working under similar light conditions, decide on lens settings based on experience and end up with accurate results. In many situations, light is extremely constant, so there is no need to meter every shot. Such situations exist inside in rooms lit mainly or only by artificial light sources. Most living and working areas are lit to a fairly even level. A constant light situation can also exist outdoors on clear, sunny days. The amount of sunlight that falls on the subject is the same everywhere and most of the day except early morning or late afternoon. The so-called sunny 16 rule works well, at least for slide film and for front- or side-lit scenes. In such situations, set the aperture at *f*/16 and the shut-

ter speed at the inverse value of the film's ISO rating. For 100 ISO, it is f/16 at 1/100; for ISO 400 at f/16 and 1/400 second or the setting closest to it. If you work with exposure values, EV 14 is correct for 50 or 64 ISO and EV 16 for 200 ISO.

While the sunny 16 rule works under the sunny lighting conditions, I suggest using an exposure meter to determine the proper aperture and shutter speed values in all lighting situations even on sunny days, perhaps for no other reason than metering having become a much more enjoyable part of photography with the modern metering methods that we have available today.

Determining Exposure with Meters

Exposure can be determined today in many different ways—simple and complicated, and with handheld meters or meters built into a viewfinder or the camera body itself. All types of light meters made by recognized companies can produce good results, but they can do so only if they are properly used. Before you decide on a specific metering system, you must learn the basics of exposure, how different meters measure the light, and how meters must be used to provide the correct exposure in all lighting and subject situations.

METERING METHODS

Exposure can be determined either by measuring the light that falls on the subject, known as incident light metering, or measuring the light that is reflected off the subject or scene, known as the reflected light metering method.

Incident Light Metering Approach

The meter measures the light falling on the subject—an approach possible with most or all handheld meters and with at least one meter prism view-finder. The cell of such a meter is usually covered with a dome-like diffusion disc. The meter reading is unaffected by the color or brightness of the subject since it just measures the light that falls on the subject.

For an incident meter reading, the meter is usually held in front of the subject with the cell facing toward the camera. In this position, all the light that falls on the subject also falls on the metering cell. For shadow or highlight readings, you make the reading either in a shaded or the lighted part of the subject, but again with the cell basically pointing towards the camera.

Incident light meters have the nice advantage of giving the same reading whether held in front of a white, gray, or black subject. You do not need to worry about the color or brightness of the subject—just about holding the meter properly. From the point of view of exposure logic, the incident meter is an excellent choice when you have time for metering and you are working from a tripod.

Since incident meter readings have to be taken where the subject is, the photographer usually has to move away from the camera to make the meter reading. This approach is time consuming to the point where it may take away the enjoyment of photography at least in location work, unsuitable for fast shooting and impractical for handheld work.

In handheld photography, and even when working from a tripod, it is faster and more practical to take a meter reading from the camera position, and even faster with a metering system built into the camera or viewfinder. When metering from the camera or through the camera, however, we no longer measure the light falling on the subject; we are measuring the light reflected off the subject.

Reflected Light Metering

Measuring the light from the camera position or through the camera means measuring the brightness of the subject as our eyes or the lens sees it. The meter reading, with the meter pointed at the subject, therefore, depends on two factors: (1) the amount of light that falls on the subject and (2) the amount of light reflected back from the subject.

Reflected Light Meter Readings

Unlike incident meter readings, reflected meter readings differ based on the color and brightness of the subject. For example, a reflected light meter reading is high for white or yellow subjects, low for black or dark brown, and somewhere in between the two for green, gray and red even if the same amount of lights falls on all these different colored subjects. The variation between light and dark colors can amount to three or four EV values or *f* stops. This fact applies to any handheld reflected meter as well as exposure meters built into cameras. They all measure the light reflected off the subject.

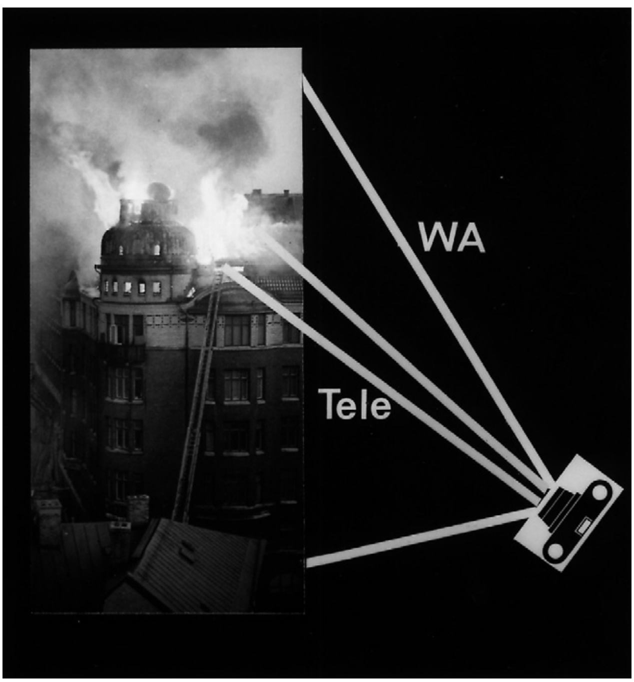
METERS AS PART OF THE CAMERA SYSTEM

Most modern medium format cameras offer some way of measuring the light in the camera. The metering system may be in the camera body or in an accessory viewfinder. Both types measure the light reflected off the subject, and they measure it through the camera lens.

Measuring the light in the camera has many advantages. The viewfinder shows what area is measured, and when the lens on the camera is changed, the measuring angle of the meter also changes. Regardless of what lens is on the camera, the viewfinder shows the measured area through that particular lens. This is especially valuable when you are working at long focal lengths and photographing distant subjects that you may not be able to meter any other way. Because you see the meter reading in the viewfinder, you can see changes in brightness while viewing the subject. The built-in meter also measures through any accessories placed in front of the lens (such as filters) or

any accessories placed between lens and film such as extension tubes, bellows, and teleconverters. With built-in meters, therefore, you can get the correct exposure readings without having to consider filter or exposure factors. The feeling or even conviction of some serious photographers that only a handheld exposure meter can give you full and precise exposure control is not correct. A well-designed built-in metering system can give you better and more precise control of the metering area, can do it in a simpler and more precise fashion and, perhaps most valuable, can do so in a fraction of the time necessary to take meter readings with a separate meter. You may even have the camera meter make some or all of the lens settings automatically, if desired.

Some photographers still feel today that a handheld exposure meter is needed for critical exposure, especially in more unusual lighting situations. That is not correct. A built-in metering system that gives you control over the measuring area and method, as is the case in a good medium format camera, can provide more precise exposure in any subject and lighting situation, and can do so without bracketing. Consequently, consider the metering possibilities in the camera seriously when deciding on a medium format camera system.



With an exposure meter in the camera measuring the light through the lens, the metered area depends on the focal length of the lens on the camera and can be determined from the image on the focusing screen.

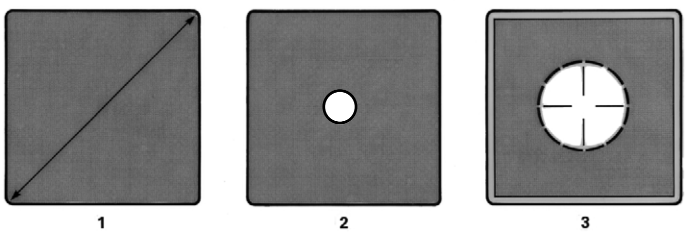
Built-in Measuring Methods

Although all built-in meters measure the light through the lens, they can measure it in different ways. The meter may measure the entire area seen in the finder equally from center to corners—known as the averaging method. There are built-in meters that work like a spotmeter, measuring only a small area of the viewfinder image. A built-in meter can also be a compromise between the two—known as center-weighted. The meter measures the entire focusing screen area, but it favors the center (or quite often the lower center). Some built-in meters measure only a center area of the composition and are then referred to as center area metering.

A popular metering method today, especially in 35 mm, and point and shoot cameras, is matrix metering. In matrix metering, the scene is electronically split into various sections, and each section is metered individually. A computer in the camera then compares the various readings and computes an average.

Some cameras only offer one of the above-mentioned measuring methods; some may give you a choice so you can use one or the other, perhaps depending on the subject or the lighting situation.

It is most important that you know exactly how your camera measures the light and then learn the basics of exposure metering keeping in mind that even a built-in meter can provide correct lens settings only if used properly.



A built-in averaging meter measures the entire area seen on the focusing screen evenly from corner to corner (1). A spotmeter measures only the small area indicated on the focusing screen (2). Center metering means measuring only or mainly a certain center area indicated on the screen (3). Center-weighted metering measures the entire image area but not evenly, favoring the center area.

Advantages of Different Metering Methods

Matrix metering undoubtedly produces the highest percentage of good exposures and is, therefore, a good system for average subjects and for general photography, and certainly for snap shooting. The computer, however, determines the exposure. You do not know exactly what areas are measured; therefore, the matrix system is not my choice. I want to know what my meter is measuring, and I want to control how the image is recorded in the camera.

A center metering or center-weighted system works well in many cases because it reduces the danger of measuring unimportant dark or

light background areas. It also gives the photographer a fairly good idea of what the meter is measuring and generally works beautifully when you have to work fast without having much time for more extensive metering approaches. Center and center-weighted metering is definitely preferable over the averaging metering method, which can be excessively affected by unimportant background areas.

A built-in spotmeter only measures the light reflected off the small outlined area on the focusing screen and is completely unaffected by any light, regardless of how bright, coming from outside areas. A built-in spotmeter must be considered the ultimate measuring instrument for the serious and critical photographer.

While the measuring area as indicated on the focusing screen is the same with all lenses, the spotmeter's measuring angle depends on the focal length of the lens. On the same camera, it could vary from perhaps 10° for an extreme wide angle lens to less than 1° for a long telephoto.

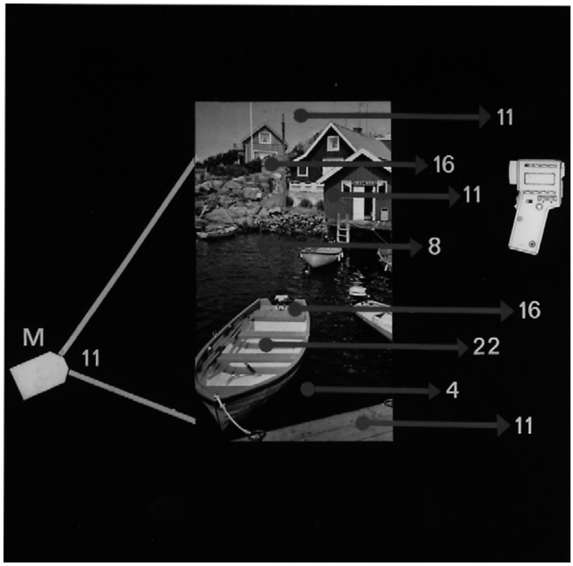
Advantages of Spot Metering

A spotmeter (whether separate or built into the camera) shows you exactly what area is being measured, and the reading is not affected by bright or dark outside areas. Knowing exactly what you are measuring allows you to determine precisely whether the indicated lens settings are correct or whether adjustments need to be made, and if so, how much. For the knowledgeable photographer, the spotmeter eliminates all guesswork and can produce perfect exposures, thus eliminating the need for shooting the image at two or more different lens settings (bracketing).

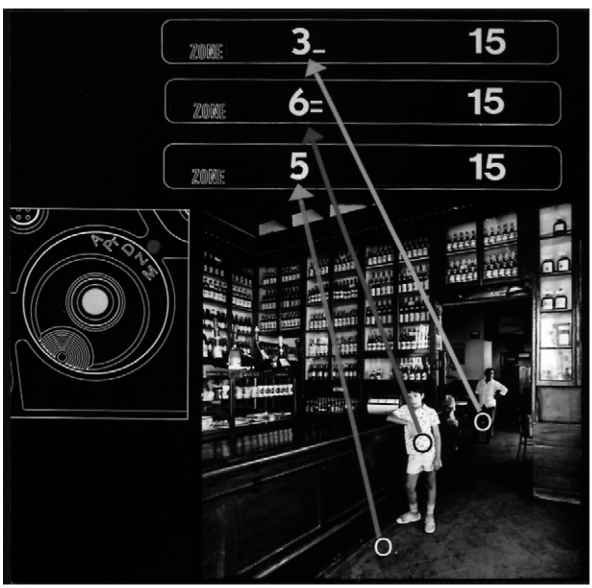
A spotmeter makes it easy to measure different areas within the subject or scene to see the differences between lighted and shaded areas, and between the main subject and the background.

Meter Operation and Automated Functions

Built-in meters vary not only in the way the subject is metered, but also in the way you set the meter information on the camera and lens. On various medium format camera systems, the meter is not in the camera but in the viewfinder, and it measures the light off the focusing screen. The information, the EV value perhaps, must then manually be transferred to the camera and/or lens. Such a system has all the benefits of "through the lens" (TTL) metering, and the benefit of seeing the measured area on the focusing screen. Such a metering system may also be coupled to the lenses and then offer the additional benefit of some form of exposure automation. If the camera with a metering system in the viewfinder offers focusing screen interchangeability, ascertain from the manufacturer or through your own tests whether all screens provide the same reading or whether adjustments are necessary.



A normal handheld exposure meter (M) gives an average exposure value for the entire area. A spotmeter (right) measures definite small areas indicated in the meter's viewfinder or on the focusing screen of an SLR camera if built into the camera.



At least one medium format camera can be set for zone mode metering where the meter readings are indicated in the viewfinder in zone values based on the Ansel Adams zone system.

Metering Automation

Medium format camera systems also come with different degrees of automation in the lens settings. For example, you may have to set the aperture manually with the camera automatically setting the shutter speed. This is known as *aperture priority*. You may have to set the shutter speed, and the aperture sets itself—known as *shutter priority*. While there are arguments regarding aperture or shutter speed priority, most serious photographers seem to prefer being able to preset the aperture for the desired depth of field.

In medium format camera systems with built-in meters, lenses and film magazines are usually electronically coupled to the camera body. The film sensitivity is set on the magazine and electronically transferred into the camera's metering system. Information between lens and camera body is also electronically transferred to the metering system.

The transfer of the electronic data is done with gold plated contacts, which can number anywhere from 6 to 12 in each camera component. In a modern digital electronic system, all information can be transferred with four contacts, which must be beneficial in reducing possible contact problems. If the metering system is in the viewfinder, as is usually the case, you may find additional contacts between the camera body and the finder.

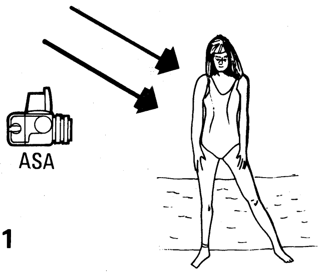
The degree of automation must be your decision. Since a medium format system is not likely used for "point and shoot" photography, complete automation should be less of a consideration than the logic and convenience of operating the metering controls. Fortunately, automation in metering and in automatic focusing has not gone as far in medium format cameras as it has on 35 mm cameras, which frequently offer a multitude of metering and focusing options combined with a display of data that may be more confusing than helpful to most photographers. I somewhat feel that these 35 mm cameras are made so the photographer no longer needs to think and learn something. If that is your desire, consider 35 mm. Fortunately, the medium format camera is still a thinking photographer's medium.

USING THE REFLECTED METER

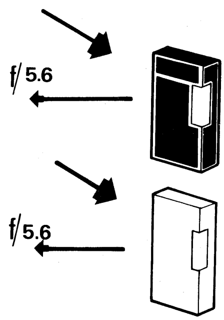
Using the Built-in Meter

All built-in meters are reflected light meters. They measure the light reflected off the area or subject that is being photographed. You must, therefore, consider all the same points that apply to metering with a handheld reflected exposure meter.

The reading on any reflected meter, handheld or built in, is determined not only by the amount of light falling on the subject, as on an incident meter, but also by the amount of light reflected off the subject. A reflected light meter shows a higher reading (smaller aperture) for white or yellow subjects, a lower reading (larger aperture) for black or dark brown, and a reading somewhere in between for green, blue, and red. The variation between white or bright yellow and dark brown or black can amount to three or four EV values or *f* stops.



1



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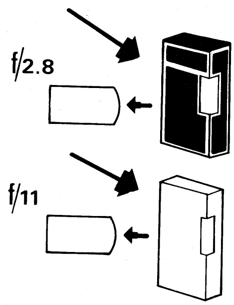
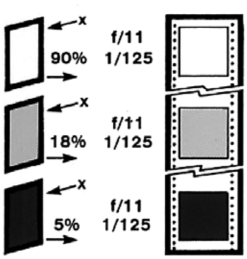
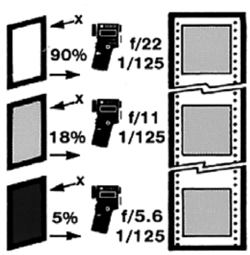


3

Correct lens settings for exposure are determined by the sensitivity of the film in the camera and the amount of light that falls on the subject (1). The reading on an incident meter is determined only by the amount of light falling on the subject thus giving the same reading for black and for white subjects (2). Reflected light meters measure the amount of light reflected off the subject and, therefore, give different readings for different colored subjects (3).

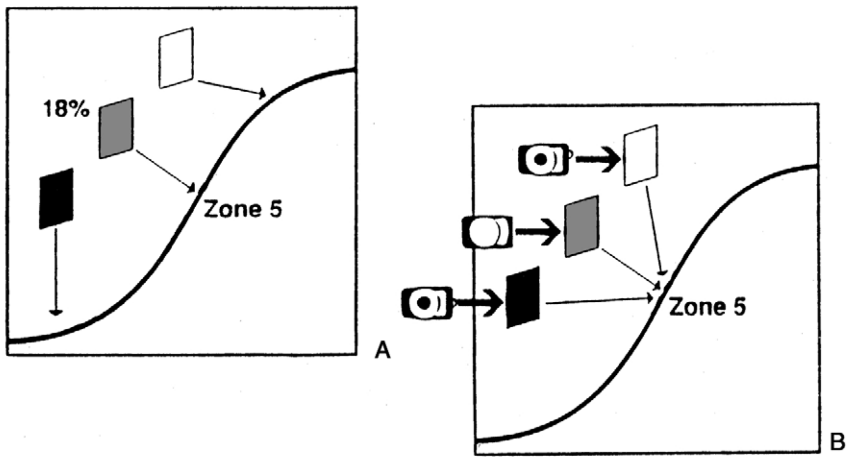


A



B

Since the lens settings that provide correct exposure are based on the amount of light falling on the subject, the same settings record white, gray, and black as white, gray, and black (A). An incident meter provides these correct lens settings. A reflected meter reading shows different values for white, gray, and black (B), and if these values are used for the exposure, white, gray, and black will all be recorded as gray.



As described by Ansel Adams, a reflected meter reading of gray, white, and black records all three as a middle gray or zone 5 (B). Normally, only middle gray should be recorded as zone 5. To place white and black at the ends of the curve, adjustments must be made in the reflected meter readings (A).

Light Reflectance and Gray Tones

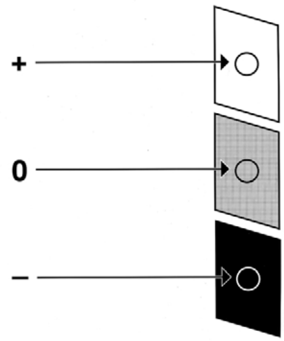
The measuring cell in every separate or built-in reflected metering device is adjusted at the factory for a specific value, and the standard in all meters is a middle gray that reflects 18 percent of the light. The gray card reflects 18 percent of the light. The reading indicated on a reflected or built-in meter is correct only if the meter is pointed at an area that has a reflectance of approximately 18 percent (a gray card or something similar). A manual adjustment must be made when it is pointed at an area that reflects more or less light. Some typical 18 percent reflectance subjects are green fields, brown earth, blue skies, suntanned faces, fall foliage, and bright red subjects.

If the reflected meter reads a brighter area, one that reflects more than 18 percent, the reading is too high and must be reduced, meaning using a larger lens aperture or using a reduced exposure value (EV), perhaps 10 instead of 11. For yellow, increase about one stop or EV, and approximately two for white. Some typical subjects requiring such adjustment are fog (+1 EV number), sand (+1 1/2), snow (+2), and white flesh tones or the palm of the hand (+ 1/2 to +1).

When a reflected or built-in meter is pointed at a darker subject, the reading is too low and the indicated aperture is too large, so the aperture must be closed down approximately one stop for brown, dark green, and dark blue.

Why the aperture must be opened when reading bright subjects and closed down for reading dark ones seems to confuse many photographers. To demonstrate this point, consider the following example: A reflected light meter reading of a subject with an 18 percent reflectance

may require settings of 1/125 second and *f*/11, and this is the setting that is correct for any colored subject. The reflected meter reading off a white subject (snow) would be 1/125 second at *f*/22. To bring the exposure to the correct 18 percent reflectance reading, you must open the aperture from *f*/22 to *f*/11.

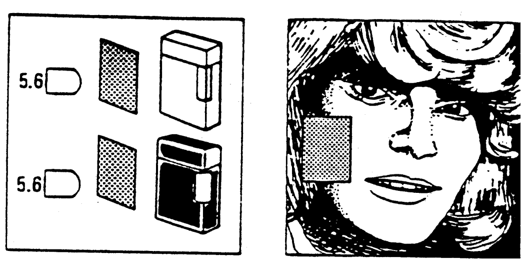


A reading from any reflected light exposure meter is correct only when taken off a subject of average brightness. Exposure must be increased when reading brighter areas and decreased when the reading is made of darker areas.

Using a Gray Card

Determining the reflectance values of different subjects and colors is not too difficult, especially when considering that the brightest subject, white snow, is only two *f* stops or EV values brighter than 18 percent gray.

Instead of taking reflected meter readings of subjects of different brightnesses and adjusting for the differences, you can take an 18 percent gray reading by using the gray card available in camera stores. Hold the gray card in front of the subject, facing the camera so that the same light falling on the subject also falls on the gray card. The reflected meter now measures 18 percent reflectance, and the reading on the meter is correct regardless of the color or brightness of the subject being photographed. Using a gray card is practical with a handheld meter, but not so when using a built-in meter.



Instead of measuring the light reflected off the subject, you can measure the light reflected off an 18 percent gray card. The reading is then the same and correct whether the card is held in front of light or dark subjects

A gray card can be helpful to determine what subject areas have the same reflectance values and can therefore be used for the reflected meter reading without the need of making a correction.

SHADED AND LIGHTED AREAS

The subjects we photograph frequently may not only have different colors, but may also be completely or partially either in shaded or in lighted areas. In such situations, the photographer must always decide whether to expose for the shaded or the lighted areas, or somewhere in between, and this decision must always be made by the photographer regardless what metering system is used, reflected, incident, handheld or built into the camera.

The logical thought might be to set the lens somewhere between the readings of the lighted and shaded areas. If the contrast is not too great, the result probably will be acceptable, at least for negatives, but never the best. Negatives exposed in this way may lack printable shadow details, and slides unquestionably will have washed-out highlights.

Black-and-white and color negatives must have adequate details in the primary shadow areas, or they will not produce a satisfactory print. With negative films, the meter reading must be made in a primary shaded area (of a subject that reflects 18 percent with a reflected or built-in meter). Transparency (positive) films must generally be exposed for the lighted areas; otherwise, highlights look overexposed, become washed out, and lose color saturation. For good exposures on slide film, the meter reading must be made in the lighted area (again of a subject with 18 percent reflectance with a reflected or built-in meter). With a

green field partially in the shade and in the sunlight, take the meter reading in the shaded part for negatives and in the lighted area for transparency film.

Many subjects are of average brightness and, therefore, any metering method provides correct lens settings for any film, especially in diffused light without lighted and shaded areas.

BRACKETING

If you use any exposure meter properly, you should have satisfactory exposure in all negatives or slides. Bracketing, which means shooting the image at two or more different lens settings, should not be necessary—at least not for every picture. You will appreciate this in candid and action photography when you do not have the luxury of a second shot, so the first one must be right. The need for bracketing can be reduced, especially when working with a metering system built into the camera where you can see precisely the color and brightness of the measured area, and see whether the measured area is in a lighted or shaded part of the subject or scene. It bothers me when I see professional photographers today, who work with built-in meters, tell other photographers that they must "bracket like crazy" or make statements such as "you never know what a good exposure will be. It could be two stops underexposed or three stops overexposed." Such statements should not be part of the photographic education.

Bracketing is still recommended in some cases when you are shooting slide film of subjects with extreme contrast. The reason for

bracketing may not be so much for obtaining a good exposure but for producing the most effective image. Perfect exposure in such cases is not necessarily determined by technical considerations but may be a matter of personal preference. A darker image may be effective because it is dramatic. Early morning shots of scenery or people may be more effective when colors are on the pastel side, creating a low-key effect.

Since today's black-and-white and color films have good exposure latitude, I suggest bracketing in full stops. A difference in one-half *f* stop is hardly noticeable in general photography. Bracketing in 1/2 or 1/3 stops, however, is still recommended for critical work on slide film such as fashion and beauty photography where flesh tones must be precise.

Some motor-driven medium format cameras or cameras equipped with an accessory motor winder now offer automatic bracketing. The camera takes three or more pictures at different exposure values by simply keeping the finger on the release. The bracketing value is programmed into the camera. With a programmed 2/3 value, the first exposure is made with the settings made on the camera and/or lens, the second and third at 2/3 stop higher and 2/3 stop lower. Automatic bracketing can be helpful in some situations, unusable in others. For example, I would not suggest using it when photographing people because you have no idea what the expressions might be when the camera makes the second and third exposure.

Taking a spot meter reading of an 18 percent reflectance area (in the lighted part for transparency film) such as the green grass on the bottom eliminates the need for corrections and is usually the fastest metering approach. A similar reading, but taken in a shaded area such as the barn in the background, is a good approach for negative film. A spot meter can eliminate or reduce the need for exposure bracketing since you know exactly what area is measured, and you know whether the reading is made of a lighted or shaded part of the subject or scene.

SPECIAL EXPOSURE SITUATIONS

Lenses at Close Focusing Distances

When any lens is moved further away from the image plane, the light is spread over a larger area with a reduction of the light actually reaching the image area. At close focusing distances, the image area receives somewhat less light. With the focusing range of medium format lenses, the loss may amount to about 1/2 *f* stop to maximum 2/3 *f* stop for a very close focusing lens. This reduction is not sufficient enough to be concerned about and is, therefore, not mentioned by most camera and lens manufacturers. A built-in metering system, of course, adjusts automatically for this reduction.

Extension tubes and bellows move lenses further from the image plane, therefore, requiring a manual adjustment in the exposure if the meter reading is not made in the camera.

Exposure with Teleconverters

Teleconverters (tele-extenders), mounted between the camera and lens for the purpose of increasing the focal length of the lens, reduce the amount of light reaching the image area. The loss is equivalent to two *f* stops for a 2× extender; one *f* stop for a 1.4×, and 1 1/2 stops for a 1.7× type. This loss of light is based on optical principles and happens in any format, on any camera, with any lens. The lens settings must be adjusted when the meter reading is made with a separate exposure meter.

With TTL metering in the camera or the prism viewfinder, no adjustment is necessary since the light is measured through the teleconverter. If the built-in meter must be set for the lens aperture, which is necessary in prism finders that are not electronically coupled to the lens, set the meter to the maximum aperture engraved on the lens.

With PC teleconverters, or PC lenses, or when shifting or tilting the lens or image plane, it is best to make the built-in meter reading before shifting or tilting the lens or image plane.

Exposure with Filters

Accessories made from colored glass or gelatin, such as filters, that cover the entire lens absorb light and require an increase in exposure. Built-in meter readings are correct with most filters because the light is measured through the filter.

Ordinary (linear) polarizing filters may distort the reading of a built-in meter and interfere with an automatic focusing system. Whether a filter does or does not interfere depends on the design of the metering and focusing system in the camera. If in doubt, check with the camera manufacturer. If the filter does affect the operation, a circular-type polarizing filter should eliminate the problem.

Special Effects Accessories

Accessories made from clear glass or acrylic material, such as close-up lenses and many diffusion filters, do not require an exposure increase. Black masks and vignettes block off some of the light that reaches a built-in meter, so the built-in meter reading made through the mask will be incorrect. The simplest way to obtain the correct reading is to take the meter reading without the mask or vignette and lock the setting, if necessary, with a built-in meter.

Double and Multiple Exposures

Combining two or more images on the same negative or transparency creates unusual images that are likely to attract attention because they create a sense of unreality. Regardless of whether you do it in the camera or electronically, the approach requires some artistic sense to decide which images go together, how the lines, shapes, and colors of the images will combine together, and how two or more images must be arranged so that the combination is more effective and beautiful than each individual image.

The double exposure can be a combination of two sharp images. More often, the best effects are obtained if only one image has a well-defined subject while the other is a pattern of colors and/or shapes, and acts as a background for the first. The second image may even be out of focus. Beautiful images have been created with brick walls, clouds, reflections, flowers, burlap, or paintings as backgrounds.

Two images exposed on the same area of the film result in overexposure if normal lens settings are used. Reduce exposure for each image about one and a half stops.

One of the two images can be made more or less visible compared to the other by changing exposure, underexposing one perhaps one stop and the other two stops. Test exposures are recommended if it is possible and practical.

Ghost Images

A figure appears as a ghost when the background is visible through the figure. To accomplish this, photograph the same area twice: once with the figure, once without, adjusting exposure as explained previously for double exposures. This technique can be successful only if the camera remains absolutely stationary between the two exposures

OTHER USES OF METERS AND GRAY CARDS

Exposure meters are ideal for determining ratios between main and fill lights, front lights and back lights, subject and background, and shaded and lighted areas. They are important or necessary to ensure even lighting distribution, especially when you are photographing interiors or

documents. When photographing documents, take meter readings in the center and at all four corners of the document.

Measuring the light falling on the background and comparing it with the light falling on the main subject is especially important in color photography. The background appears on the film in the color observed visually only if it receives the same amount of light as the main subject. Check the lighting ratio with an incident meter or a reflected meter in combination with a gray card.

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CHAPTER 12

Medium Format Flash Photography

For many years, electronic flash has been the most popular artificial light source in the studio and on location. Portable flash units are small yet produce a large amount of light. The duration of the flash is very short and, therefore, freezes fast action and reduces the danger of unsharp images owing to camera movement. The color temperature of electronic flash matches that of normal daylight, so the two can be combined in color photography.

This chapter mainly describes flash photography with portable units rather than studio lights. The use and application of studio lights is the same in medium format photography as in 35 mm or when working with large format cameras.

FLASH SYNCHRONIZATION

The electronic flash must fire when the shutter is fully open; otherwise a completely or partially blank or underexposed image results. With focal plane shutters, this happens only up to a certain shutter speed, which is somewhat longer on medium format cameras than on 35s because the shutter curtain has to travel further and needs more time to do so.

Check the camera specification sheets. Lens shutters can be used with flash at all shutter speeds. This can be very helpful in outdoor work on bright sunny days. It allows shooting at larger apertures and, by doing so, you not only blur the background, but you also need less light from the flash unit, thereby obtain a greater number of flashes from a battery charge.

Checking Flash Synchronization

With a medium format camera with interchangeable magazines, you have an easy way to check whether the flash is synchronized with the shutter. With lens shutters, set the diaphragm to its widest aperture and the camera at the shutter speed to be checked. Attach the synchronization cord to the PC flash socket. With the flash unit properly connected, point the camera toward a light wall. Place your eye approximately 1 ft. behind the rear of the camera with the film magazine removed. Trip the shutter while looking through the back of the camera. If you see a perfect full circle, the flash is synchronized. If the flash is not visible at all or not through the fully open lens, the flash synchronization is off. For a complete check, test synchronization at all shutter speeds. Check a focal plane shutter in the same way. The flash is synchronized with the focal plane shutter if you can see the flash over the entire image area.

FLASH UNIT SIZE AND BATTERIES

The size of a portable flash unit is determined mainly by the power source, which determines the brightness of the flash and the number of flashes per charge. A small camera mounted flash is fine if you work mainly within about 5 m (17 ft.) of your subject. I also work with a very compact flash unit in all my outdoor flash fill work. Most of these images are made at larger apertures to blur the background, and I reduce the flash considerably so it just adds a little light into the face and the eyes. Using a compact flash unit mounted directly on the camera makes carrying the camera much easier and gives me more enjoyment from photography.

A compact unit naturally does not give sufficient light to photograph a banquet hall or factory interior, especially when the required depth of field means using a small aperture.

Compact flash units are usually powered by regular or rechargeable flashlight batteries. Rechargeable batteries are the choice of the working photographer who uses flash frequently. They can be recharged a great number of times, and if used frequently, are more economical than regular penlight batteries. The common use of ISO 400 film for professional location work (for example, weddings) has reduced the need of carrying heavier flash units with a separate power pack for most location work.

LIGHT OUTPUT AND GUIDE NUMBERS

The brightness of portable units is indicated in guide numbers. The guide number is the product of the lens aperture multiplied by the distance needed for correct exposure. For any flash unit, the guide number varies with the speed of the film you use. Most companies quote the guide number for ISO 100 (21 DIN) film.

If the guide number for a certain film sensitivity is not available, you can determine it easily from the guide number indicated for another

ISO value. For an ISO rating twice as high (or the DIN rating three points higher), multiply the guide number by 1.4; for example, if the guide number for ISO 100 film is 110, then the guide number for ISO 200 is $110 \times 1.4 = 154$. Divide by 1.4 for an ISO rating of half (or a DIN value three points lower); for example, if the guide number for 21 DIN is 42, the guide number for 18 DIN is $42 \div 1.4 = 30$.

COVERING POWER

Guide numbers do not tell the entire story about the performance of a flash unit. They do not indicate the size of the area over which the light is spread; somewhat like the focal length of a lens does not indicate the covering power of the lens.

You can have a flash unit that is very bright but covers only a limited area. The covering power indicates the area over which the unit spreads the light fairly evenly. This is an important specification, especially if you work with wide angle lenses.

All portable units will cover the area of the standard lens; most of them also cover the area of a wide angle that has a focal length just a little shorter than the standard (for example, 60 mm when the standard lens is 80 mm). Some units may not cover a larger area so check the specifications. Many portable units have an accessory lens or diffuser for increasing the covering power or may allow moving the reflector to provide a larger covering power. If proper coverage is not possible, consider incident or bounced flash, multiple flash, or bare bulbs.

READY LIGHT AND EXPOSURE SIGNAL

The ready light indicates when the flash unit's capacitor is charged and when the camera can be released again. If a picture is made before the ready light is on, the flash will not fire or will fire with less than the full amount of light—a frequent cause of underexposure. The ready light is usually positioned somewhere in the rear of the flash unit where it can easily be seen. Seeing the ready light on the flash unit still requires removing the eye from the viewfinder of the camera.

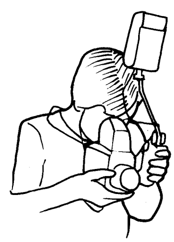
This annoying problem that can easily make you miss an important shot is eliminated with a dedicated flash system. The ready light is visible in the viewfinder of the camera so you can keep your eye in the viewfinder, never losing contact with your subject. This wonderful placement of the ready light must be considered one of the great benefits of dedicated flash, especially when you need to work fast. The exposure signal, which indicates whether or not the flash illumination was sufficient for the picture is also visible in the viewfinder in such a system. Dedicated flash is already the standard for wedding photography and should be seriously considered as the ultimate solution for all location flash photography.

USE AND PLACEMENT OF THE FLASH UNIT

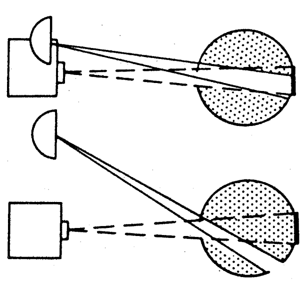
Small portable flash units can be mounted directly on cameras. While this set up may not look professional, it works at least for outdoor fill flash work where the flash is a secondary light. Although the flash may be right above the lens, I have never seen *pink eye* in my pictures probably because the flash illumination is reduced to the point where it just adds a little light to the eyes and face. For indoor work where the flash becomes the main light, you want to place the unit so the flash head is 8 to 10 in. (20 to 25 cm) straight above the camera lens, using some kind of a camera/flash bracket. Placing the flash unit straight above the lens is recommended. Shadows on background walls then usually fall below the people's shoulders where they are less distracting than shadows on the sides.

Placing the flash head several inches above the camera lens also avoids pink eye. Pink eye can also be avoided by having people look slightly to the side rather than directly into the camera.

The flat lighting produced by a camera-mounted flash may not be the most beautiful when the flash is the main or only light source, but can be and usually is, a perfect light for fill flash, especially when it is reduced and softened somewhat.



A good position for a portable flash unit is directly above the camera lens—high enough to avoid pink eye.



Pink eye is caused by the reflection of the flash light off the back of the blood-filled retina (top). You can avoid this problem by placing the flash farther from the camera so that the retina is not lit straight on (bottom).

Multiple Flash

While a flash placed on top of a camera is fine for many applications, for practically all applications outdoors, you also may want the option of separating flash and camera, or using a second flash unit for better results. These options exist with all medium format cameras where the flash is always a separate unit.

When flash is a main light, you can produce more professional results by using two flash heads—a main light and a fill—as you would in a studio set-up. Also, like in a studio, the main light may be a side or 3/4 light, the fill light can come right from the camera. Both flash units must fire simultaneously with the flash on the camera triggering the remote main light.

The main light on the side can be used in the manual mode setting with the lens aperture based on the distance or in the automatic mode. The fill light on or near the camera should be in the automatic or dedicated mode, but with the flash reduced the equivalent of one or two stops so it does not become the main light.

Soft Boxes

The flash heads on portable flash units are often small, producing a very directional light from any distance and giving flash pictures that typical flash look. For anything more than snapshots, you want to soften the light. A diffusion filter on the flash head will not soften the light from the flash or any other light unit. The filter simply reduces the amount of light. To soften the light, you must increase the size of the light source. This is done in the studio with soft boxes, and it is done in the same fashion with a portable flash unit. Small soft boxes are readily available and can easily be placed over the flash. The soft box will increase the size from perhaps 2 inches to 5 or even 7 inches without reducing the amount of light to any objectionable degree.

I highly recommend using soft boxes at least for more formal work. The results look much more professional without complicating the photography to a point where you need an assistant to set up and hold reflectors, light diffusion screens, or all kinds of other gadgets.

Some photographers accomplish similar results with reflected flash. The flash head is pointed upwards towards a white reflecting bouncer attached to the flash. The reflector, which must be larger than the flash head, then bounces the light onto the subject. I found that using a small soft box is more practical.

Indirect and Bounced Flash

Indirect flash with the light reflected off umbrellas, reflectors, walls, or ceilings rather than shining directly on the subject, produces a softer

overall light. The light illuminates the subject from various angles and therefore reduces or eliminates harsh, sharp shadows.

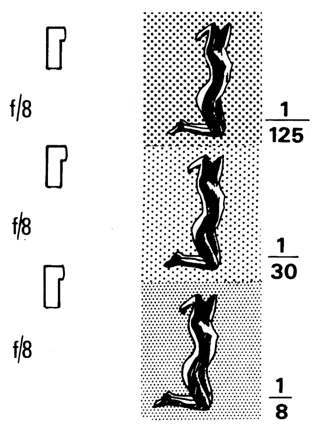
Umbrellas offer a simple, portable solution. Flash unit and umbrella are mounted together, with the flash tube pointing at the center of the umbrella. The softness of the lighting produced by umbrellas and any other reflectors is directly related to their size and distance from the subject. The larger the umbrella or reflector, the larger is the spread of light. If positioned close to the subject, the umbrella or reflector lights the subject from different angles, producing an almost shadowless light. The same umbrella or reflector placed far from the subject becomes more directional with stronger shadows; almost like direct flash. For the softest light, use the largest-sized umbrella, positioned close to the subject.

Walls and ceilings in a room can be used to bounce flash. Ceilings are satisfactory but illuminating people from above does not produce a very flattering image. Walls are usually more satisfactory.

Bare bulb flash offers the advantage of illuminating the entire room, and its reflected light reaches the people from various angles. The light that hits the people directly from the bare bulb is harsh and not too beautiful, especially when the flash is fairly close. Bare bulb, in my opinion, serves no purpose outdoors.

Slave Units

Off-the-camera flash units, studio and portable types, can be fired by slave units, eliminating the need for cable connections between camera and flash. One small flash, mounted on the camera, can fire one or any number of flash units away from the camera as long as each flash unit is equipped with its own slave.



The exposure for the electronic flash is determined only by the aperture. The shutter speed has no effect but must be within the synchronization range of the shutter.

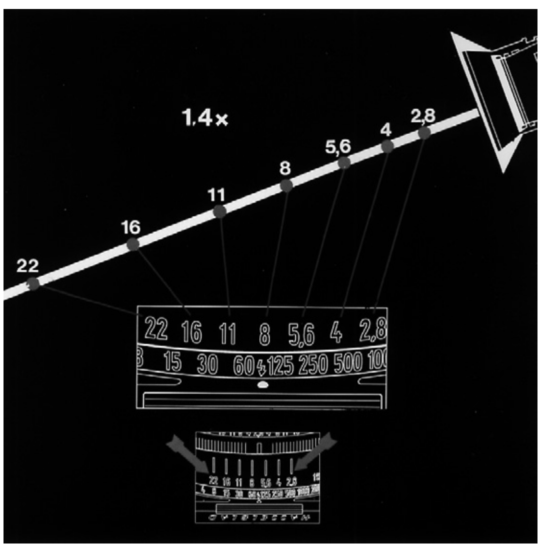
OPERATING THE PORTABLE FLASH UNIT

There are three basic methods of operating a flash unit, depending on the type and make of camera.

Manual Flash

In manual operation, the flash always produces the same amount of light regardless how far it is from the subject. As light is reduced with the distance, the lens aperture must be adjusted to the flash to subject distance. The further the distance, the larger the aperture must be. There is usually a chart on the flash unit that gives you this information for different film sensitivities so you need not make calculations. If you want to make the calculations, keep in mind that everything with light works in the square root of 2. That means that if you want to increase the light of any light source the equivalent of one stop, you do not move the light to half the distance but only 1.4× closer.

Manual flash is great when the flash is at a fixed distance from the subject as in studio applications, but it will slow you down when the flash is part of the camera or mounted on the camera. Whenever you move closer or further from the subject, you must change the aperture. Manual flash is not the suggested solution for such work, especially not when you must work fast.



The brightness of any light source is reduced or increased the equivalent of one stop if the light source is moved 1.4× closer or further away, for instance from 11 feet to 16 feet or to 8 feet. The aperture values on the lens can be used to determine distances since they are also multiples of 1.4.

Automatic Flash

In the automatic mode, a sensor on the flash unit determines the duration of the flash, making it shorter when the flash is close to the subject or the lens is set to a large aperture, keeping it on longer when the subject is further away or a smaller aperture is used.

You can move closer or further to the subject without making any changes in the lens aperture. Although you do not know or see what part of the image the sensor measures, automatic flash produces good results in most cases. It certainly allows fast shooting even when you move to different distances. The film's ISO is set on the flash unit. Most units have an adjustment for reducing the flash illumination to 1/2, 1/4, or even further while maintaining the exposure automation. Automatic flash can be used with any medium format camera.

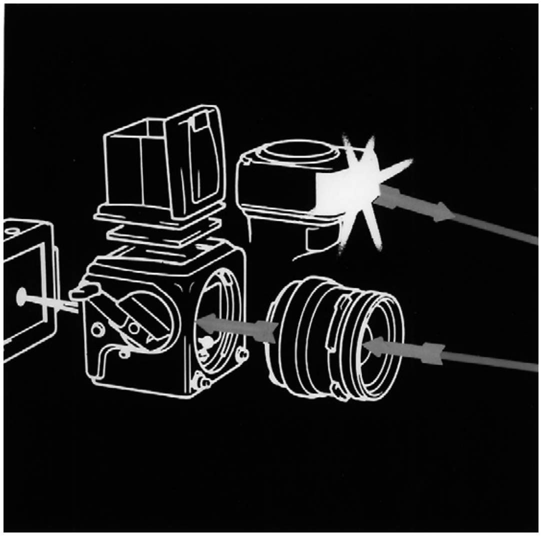
Dedicated Flash

The modern location flash approach is known as dedicated, which means the flash is electronically coupled to the camera with the light measured by a sensor in the camera.

The dedicated flash approach requires a camera that has the electronic components necessary for that purpose built in, and it also needs a flash unit that is electronically compatible with that camera. Flash units that have different settings are set to TTL for dedicated operation.

Most medium format cameras today are made for dedicated flash photography, and the camera manufacturer may also have the necessary flash units for that purpose available or can tell you what types and makes of flash units can be used. Some flash units that do not have the necessary electronics built in can be used for dedicated operation in combination with an adapter made by the camera company or the manufacturer of the flash unit. Obtain complete information from the manufacturer of your camera.

Unlike in point and shoot cameras where the flash operation is completely automatic giving you no control over the flash and the lens aperture, in medium format cameras you usually maintain control over the lens, the camera settings and the resulting flash exposure. You can select the aperture and shutter speed that produces the desired depth of field and the desired exposure for the existing light. You probably also have the possibility of controlling the flash exposure. This is essential for location flash photography. Make certain that the camera you select gives you this control if you plan to use electronic flash outdoors.



In a dedicated flash system, a sensor in the camera measures the light that is reflected off the subject and reflected off the film plane, and turns off the flash automatically after the sensor received the proper amount of light for a correct flash exposure.

Dedicated flash produces excellent and consistent flash exposures automatically.

Advantages of Dedicated Flash Operation. Both automatic and dedicated flash give you the freedom to move around, photographing from different distances without worrying about aperture adjustments. This approach allows you to capture actions and happenings instantly and with consistently good exposures both indoors where flash may be the main light or outdoors where flash is used to fill in shaded areas.

The dedicated mode has many additional advantages that justify serious consideration by most medium format photographers. In dedicated, as in automatic flash, flash exposure is determined by the duration of the flash. In a dedicated system, however, the sensor that measures the flash illumination and determines when to turn off the flash is in the camera and usually measures the light reflected off the image plane. The area that is measured can easily and accurately be determined in the viewfinder when making the composition. As a result, exposures are amazingly accurate and consistent because they are based on the light that actually falls on the image plane.

The sensor also measures the light through the lens so the measuring area is directly related to the area coverage of each lens. The flash ready light is visible in the camera's viewfinder. You can keep your eye constantly in the finder and never lose contact with your subject.

Dedicated flash gives you the peace of knowing that exposures are correct because an exposure signal shows whether the film received sufficient light. This signal is also visible in the camera's viewfinder. A dedicated system also reduces the danger of making mistakes, such as shooting at a shutter speed that is not synchronized for flash. There are usually warning signals or controls in the camera to minimize this possibility. A good dedicated system will also offer simple and excellent solutions for changing the flash exposure in fractions of *f* stops.

MAKING THE EXISTING LIGHT PART OF THE PICTURE

Any shutter speed that synchronizes for flash produces the proper exposures for the flash-lit subject, but it may not produce the most effective image because it does not consider the amount of existing light in the room or the brightness of the daylight outdoors. You want to make this existing light part of your picture in many indoor situations and in almost all outdoor work.

Outdoor pictures and many flash pictures indoors are more effective and look more natural when the existing light is part of the image—if you can see the location instead of the people being surrounded by darkness. The electronic flash is then used to augment the existing lighting.

It is simple to produce such flash images but also requires attention to the shutter speed setting. The shutter speed determines to what extent the existing light becomes part of the picture.

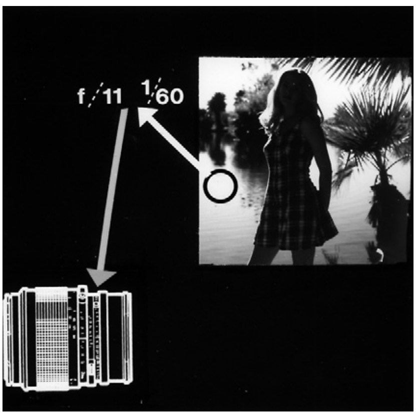
Determining Exposure for the Existing Light

Start by measuring the daylight or the room light using your usual metering method with a built-in or a separate handheld meter. Then decide

whether the background should be recorded as it is, or if it should be brighter or darker, and use the meter reading to produce the desired results. If you set the aperture and shutter speed as shown on the meter, the background will be recorded at the "normal" level. You can make it darker by selecting a shorter shutter speed and lighter by setting to a longer shutter speed (without changing the aperture).

When using a focal plane shutter, the shutter speed must not be shorter than specified in the instruction book.

Use exactly the same approach if the interior of a room is to be part of the picture in an indoor situation. Take a meter reading of the existing light in the room and set the aperture and shutter speed accordingly, or perhaps for slight underexposure equivalent to one stop. A faster film may be necessary to accomplish the desired results.



Correct exposure for the background is obtained by setting the aperture and shutter speed based on the reading from an exposure meter. The flash exposure is automatic.

While the flash exposure is automatic, the exposure for the existing light in a room or the outdoors can be changed drastically with the shutter speed. At 1/60 second, the model is surrounded by darkness (left). At 1/15 second, the room becomes part of the picture (right).

Flash Exposure

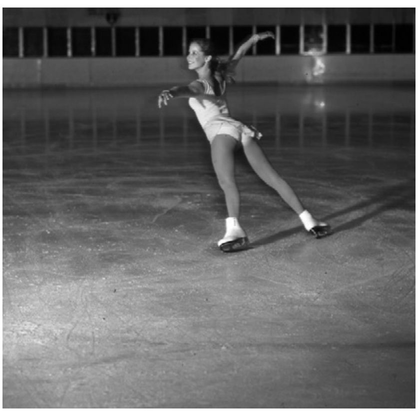
The flash exposure is determined automatically by the sensor in the camera and produces the desired results in many situations, especially indoors where the flash is usually the main light. In other situations, especially outdoors where the flash is usually not the main light but is simply used to fill, a reduction in the flash exposure will produce a more natural image with the sunlight being brighter than the flash fill. Most pictures are most effective when the flash fill is hardly noticeable. For this purpose you need a camera that offers this adjustment to at least –2 *f* stops, preferably to –3.

The adjustment is usually done electronically by programming a flash fill value, in fractions of *f* stops, into the camera. Other cameras may have an ISO dial specifically for dedicated flash. This dial is normally set for the correct ISO value. To reduce the flash exposure, set the dial to a higher ISO, to 200 for reducing the flash exposure the equivalent of one stop with ISO 100 film, to ISO 400 for a 2-stop reduction. Reducing the flash the equivalent of one *f* stop with the ISO dial produces the same results as an electronic reduction to –1. In automatic flash, setting the ISO dial on the flash unit in the same fashion reduces the flash exposure in the same way. Reducing the power ratio on the automatic flash unit reduces the flash exposure only in the manual, not the automatic mode.

To determine the best flash exposure for your type of photography, it is best to make a film test with your camera, flash unit, and your type of film, and have the film processed in your laboratory. I have found that a reduction to at least –2 produces generally pleasing results. In many cases, especially in candid work, I have reduced as much as –3 in bright sunlight with the sun being a back or side light.

The flash exposure is changed by programming the desired reduction into the camera. A setting of –1 reduces the flash the equivalent of one *f* stop. On some medium format camera models, setting the ISO on the flash dial to a higher value reduces the flash exposure. Setting the flash dial to ISO 200 for ISO 100 film also reduces the flash the equivalent of one *f* stop.

Without an adjustment, the dedicated flash unit produces a flash exposure equal to the daylight. The use of flash is quite obvious (left). Reducing the flash exposure produces a more natural portrait light with the flash just filling the shaded areas (right). Flash reduced the equivalent of 2 *f* stops.



The secondary ghost image created by the existing light in the arena at a 1/60 second shutter speed is the reason for the unsharpness (left). A 1/500 second shutter speed eliminates the effect from the existing light and produces a sharper, more effective image against a dark background (right).

OTHER EXPOSURE CONSIDERATIONS

Subject Brightness

While dedicated and automatic flashes produce good exposures in most situations, we must be aware that they can produce perfect results only if the subject that reflects the light to the sensor has an 18 percent reflectance value, which is a medium shade of color, a gray card.

A bright subject reflects more light to the sensor and shortens the flash duration causing underexposure. You can compensate for this by setting the flash fill function to a plus value or by setting the ISO dial to a lower setting. Do the opposite for darker subjects. Consider this when working in the automatic or dedicated flash approach.

In practical photography, the differences seldom seem to exceed more than 2/3 *f* stops—not really enough to be concerned with negative film. This is true even in a wedding photograph with a bride dressed in white and the groom in black. In most images, the sensor does not measure only white or only black but a combination of different shades that may also include flesh tones, flowers, etc.

Film Reflectance

In a dedicated flash system, where the sensor measures the light reflected off the film emulsion, the sensor must be adjusted to the reflectance of the film. There are reflectance differences among the films, which are usually not pointed out to the photographer. The differences are not too great, especially among transparency films, and rarely exceed 2/3 of a stop with negative emulsions reflecting more light causing slight underexposure. The range exceeds this with special films like Polaroid, for example. Some manufacturers have charts available, but even if they do, keep in mind that films change constantly and may be changed without informing the public. It is better to make your own film test.

Make the test with your camera and your dedicated flash system by photographing a known subject, preferably an 18 percent gray card covering the entire measuring area of the sensor on your type of film and have the film processed in your lab. Underexposure can be corrected by setting the flash fill fraction to a + value or the ISO to a lower value.

Color of Light and Flash

When combing flash with existing light, you must also pay attention to the color of both light sources. You want to match the two light sources as close as possible. There is no problem during regular daylight hours since the electronic flash has about the same color temperature as noontime sunlight. If you use flash as a fill light early in the morning or late afternoon, the flash fill will be too blue compared to the warm sunlight. Place a warming filter over the flash unit. A filter like 81B or 81C should help. Gelatin filters are good for this purpose, but anything is usable. You do not need a quality filter since the filter is used only to change the color of the light. You do not take a picture through the filter.

OTHER FLASH APPLICATIONS

Flash can improve location photography not only when photographing people. Adding flash can improve many pictures taken on location with unusable or unknown lighting.

For example, fluorescent lights do not produce good colors. Flash can help and produce more pleasing colors, especially flesh tones. The flash is then an addition to the fluorescents, not a replacement and not necessarily used to light the entire room, only the people in the room.

Flash has a wonderful application in nature photography. When the sky is overcast, producing flat lighting, frequently also of questionable color, flash can add contrast, produce lighted and shaded areas, making your nature shots look as if they were taken in sunlight. Wooded areas may be in complete shade even on a sunny day, resulting in long exposures that are frequently associated with a blue color cast typical when photographing in shaded areas. Flash eliminates such problems and simplifies the photography by allowing shorter shutter speed. The short flash duration also reduces the danger of camera or subject movement showing up on your pictures. You can also place the flash unit so it produces either a front, side, back or overhead light without having to wait for the sun to move to the proper spot.

Ghost Image

Shutter speeds are an important consideration when you are photographing fast moving subjects, such as indoor sports. To freeze action, you want to get an exposure from the flash only, not from the ambient light. The latter produces a ghost image—an image that overlaps the sharp flash image. The total effect may be unsharpness. In such situations, you actually do the opposite from what you do when photographing people in a beautiful room—you do not want to make the room part of the image.

In sports arenas, the existing lights can be very bright, causing a ghost image even at relatively fast shutter speeds of 1/30 or 1/60 second. For this type of photography, flash synchronization up to 1/500 second is a prime requirement. It is the only way to eliminate ghost images.

There are also times when you may want to use the combination of a sharp image created by the flash, and the blur produced by the ambient light and a long shutter speed. The ghost (streak) effect can be produced either with a moving subject or a moving camera.

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CHAPTER 13

Close-Up Photography

CAMERA DESIGNS

A medium format camera design where the lens is connected to the camera with a bellows allows photography at closer distances than the more common camera design where the lens is attached directly to the camera body for the utmost in ruggedness and greatest precision in the optical alignment. Focusing on such a camera is done at all distances, far or close, by extending the bellows more or less, eliminating the need for a focusing mechanism in each lens. While the focusing range is limited by the length of the bellows, you might be able to do most or all close-up work with this type camera. For extreme close-up work, on the other hand, you may still need a close-up accessory such as an extension tube.

On other medium format SLR cameras, close-up accessories allow you taking pictures below the minimum focusing distance of the lens. Close-up accessories are easy to use and do not complicate operation or require extensive calculations, at least not if you understand how these accessories perform optically.

An SLR camera should be considered for all close-up photography. You can always see the covered area on the focusing screen regardless what the subject distance might be or what close-up accessories are used.

A motor-driven camera offers advantages. The motor-driven film advance eliminates the danger of moving the camera when you advance the film manually. Even a slight movement of the camera between shots can be disturbing in a critical close-up alignment (for example, copying). A tripod is recommended, but not essential, for most close-up work. In handheld close-up photography, focusing is made easier by pre-setting the focus setting on the lens and then moving the camera forward or backward until the subject is sharp on the focusing screen.

You can hold the camera with both hands in the most convenient fashion rather than holding the camera with one hand and using the other for focusing the lens.

Close-up photographs can add the most interesting images to your library, showing greatly magnified details that we normally overlook.

LENSES FOR CLOSE-UP PHOTOGRAPHY

True Makro lenses that focus down to inches, which are popular in 35 mm, are not made for medium format cameras because the larger size and greater weight of the medium format lenses makes extending the focusing range rather difficult.

Photographic lenses behave in close-up photography exactly as they do at longer distances. A longer focal length lens covers a smaller area from the same distance. The camera-to-subject distance determines the perspective. Different focal length lenses cover different background areas. Different focal length lenses can also cover the same area from different distances. Longer focal length lenses blur backgrounds more than do shorter ones at the same lens opening.

Standard and short telephotos should produce good image quality in close-up photography with a medium format camera system, and these focal lengths are usually the best choice from an operating point of view. Some manufacturers have some lenses that are optically designed to produce the best quality at closer distances. Such lenses deserve first consideration if they are available.

The retrofocus wide angle lenses on SLR cameras are good at long distances but suffer a loss of quality at close distances, especially when used in combination with close-up accessories. The retrofocus types with floating lens elements are better and can be considered if they cover the right area from the correct distance. Close down the aperture somewhat when using the lens in combination with accessories.

CLOSE-UP ACCESSORIES

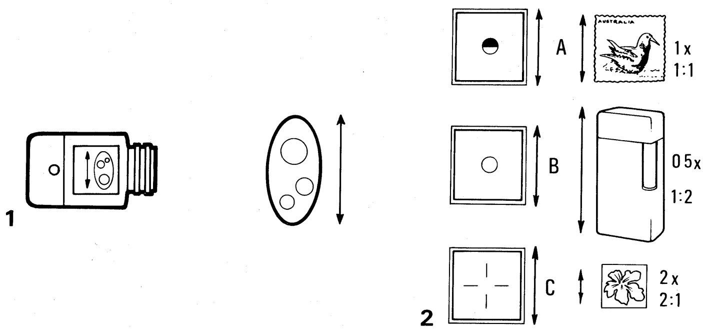
The range of close-up accessories available for most medium format camera systems with interchangeable lenses includes close-up lenses, extension tubes of various lengths, and bellows. The choice depends mainly on the required magnification, but also on operating convenience. To understand close-up photography and the use of the various accessories, you must know what magnification values mean since practically everything in close-up work revolves around magnification.

MAGNIFICATION

Magnification indicates how much larger (or smaller) a subject is recorded in the camera.

In some countries, the magnification is indicated in fractions and in others it is indicated in ratios. For example, A 2× magnification, meaning the image is twice as large as the subject, may also be indicated by 2:1. The equivalent value for a 0.5× magnification, meaning the image is half the size of the subject, can also read 1:2.

Magnification is the ratio in size between the actual subject and the size of the image recorded in the camera. The large medium format focusing screen allows you to measure the image size after sliding off the viewfinder. A more practical way is to base the size on the area coverage. We know the dimension of the film format, being 55 mm for both sides of the 2 1/4 in. square or the longer side of 4.5 cm × 6 cm, and about 70 mm for the long side of the 6 × 7 cm format. You can calculate magnification by dividing the negative side into the width or length of the area covered. If you can cover an area 220 mm wide, the magnification is 55 ÷ 220 = 0.25 or 1:4 for the 2 1/4 in. square. If you cover a very small area of 27 mm on the same format, the magnification is 2× or 2:1.



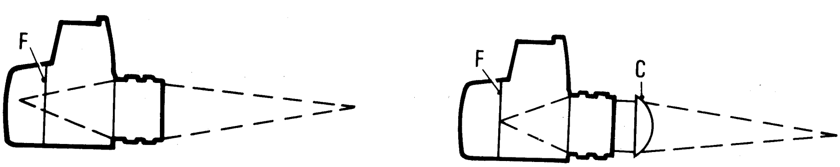
Magnification is the size relationship between the size of the film format and the size of the area coverage (1). If the subject is about the same size as the image format in the camera, we have 1:1 magnification (A); when the subject is twice as large, there is 0.5× or 1:2 magnification (B); and when the image area is filled with a small subject that is half as large, there is 2× or 2:1 magnification (C) (2).

CLOSE-UP LENSES

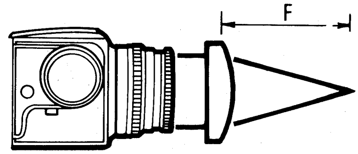
Close-up lenses, also called Proxar lenses, are positive lens elements that are mounted in front of the camera lens like a filter. They should be positioned as close to the front element as possible. Close-up lenses can be used with any focal length lens and also with zoom lenses, as well as on cameras with non-interchangeable lenses.

Most manufacturers indicate the strength of their close-up lenses in diopter power like eyeglass lenses; others engrave the focal length on the lens. Diopter is just another way of expressing the focal length of a lens with a 1 diopter equaling a focal length of 1 meter or 39 1/2 in. A 2 diopter lens has half the above values (50 cm or 19 3/4 in.) and a 3 diopter lens has 1/3 of the values.

The diopter power or focal length determines the subject distance at which the close-up lens produces sharp images. With the lens on the camera set at infinity, a close-up lens always produces a sharp image when the subject distance, measured from the close-up lens, is equal to the focal length of the close-up lens (1 m or 39 1/2 in. for a 1 diopter lens). Again, these distances are measured from the close-up lens, not from the image plane.



A subject that is closer to the lens than its minimum focusing distance forms its image behind the image plane (F) (left). The addition of a close-up lens (C) can bring the image onto the image plane.



With the lens on the camera set to infinity, the correct subject distance measured from the close-up lens is always equal to the focal length (F) of the close-up lens.

Distance being equal to the focal length of the close-up lens applies to any camera and any focal length lens on the camera, but only when the focusing ring on the lens is set at infinity. The focusing ring on the lenses does not need to be at infinity when we take the picture. We can use the focusing ring as we normally do for fine focusing and also for taking pictures that are at somewhat closer distances than for the infinity setting.

Since adding a close-up lens means adding a lens element to a well-corrected camera lens, image quality on the edges suffers somewhat. The degree of sharpness loss is determined mainly by the power of the close-up lens, but also by the quality of the lens itself. Stopping down two to three *f* stops with weak close-up lenses (up to 2 diopters) is highly recommended. The use of stronger close-up lenses, 3 diopters and more, is not recommended for use with any medium format camera.

Close-up lenses do not alter the exposure, so you can use the lens settings obtained from your normal exposure meter.

You can combine two close-up lenses. The power of the combination is obtained by adding the two diopter strengths. For example, a +1 and a +2 close-up lens yields a +3 diopter lens. Such combinations are definitely not recommended for medium format work.

Close-up lenses are the easiest of the close-up accessories to use, but they are meant only for low magnification work—when it is necessary to go just a little closer than the focusing range of the lens. However, since image sharpness is, and should always be, a main concern in medium format photography, selecting other close-up accessories that maintain sharpness should be considered for all close-up photography even for low magnification work.

EXTENSION TUBES AND BELLOWS

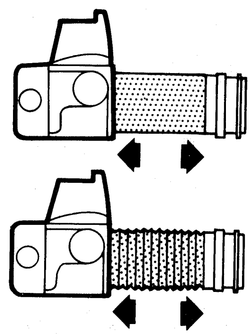
Extension tubes and bellows are physically different but serve the same purpose in close-up photography. Both are mounted between the camera and lens so that the lens is farther away from the image plane. They are, therefore, an extension of the focusing ring. The longer the tube or bellows you use with any particular focal length lens, the closer you can photograph and consequently the higher the magnification is.

The same extension tube or extension on the bellows gives a higher magnification with shorter focal length lenses—a lower magnifi-

cation with lenses of longer focal length. The necessary extension length for various lenses can be determined from the following formula:

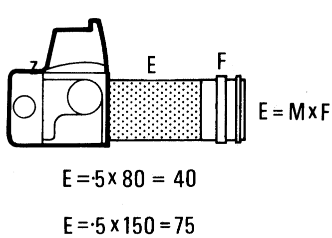
length of extension = focal length of lens × magnification.

For example, the extension necessary to obtain a 0.5 times magnification with an 80 mm lens is 80 × 0.5 = 40 mm; and with a 120 mm lens, 120 × 0.5 = 60 mm. Knowing this relationship eliminates time-consuming experimenting, moving cameras, and adding and changing lenses and accessories to find out what area you can cover.

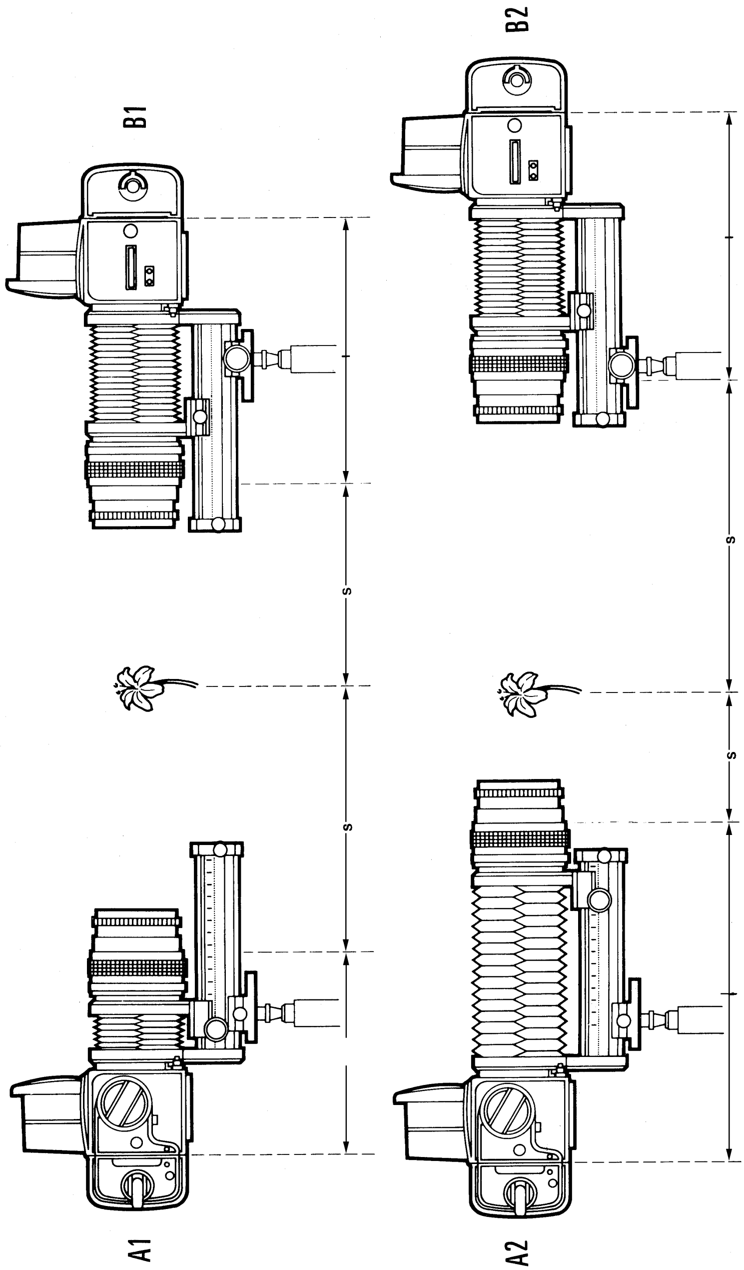


Extension tubes and bellows move the lens farther away from the image plane. A bellows extended to the same length as a tube produces the same magnification and image with the same lens.

Extension tubes are small, easy to carry and mount on cameras and lenses. You can combine tubes for a longer extension. Depending on the camera and focal length of lens, they can provide magnifications up to life size. If close-up photography is not a daily affair, extension tubes will serve your needs. Since they are fixed in length, you may need two or three tubes. But they are small and lightweight, so even two or three are easy to carry.



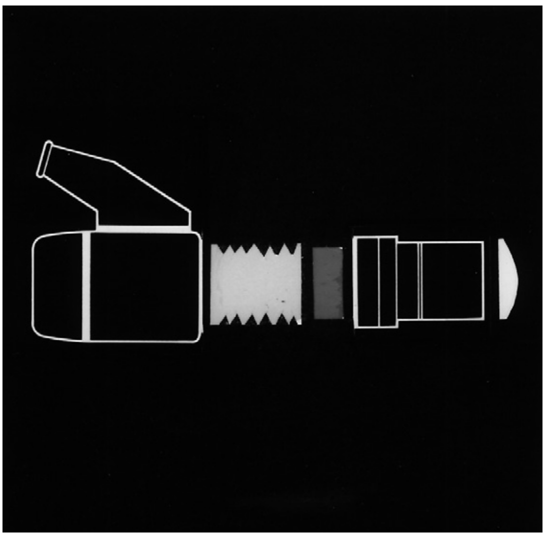
The necessary length of an extension tube or bellows for a particular magnification can be determined easily from the formula E = M × F, where E is the length of the tube or bellows, M is the magnification, and F is the focal length of the lens. For a 0.5 magnification, an 80 mm lens needs a 40 mm extension, a 150 mm lens requires 75 mm.



A good bellows has two controls. One moves the entire camera-lens combination and thus changes the distance from the lens to the subject (S) for focusing (B1 and B2). The other control changes the distance between the lens and image plane, and thus changes the image distance (I) and the magnification (A1 and A2).

Bellows can be extended longer than what you would normally consider doing with extension tubes and can provide higher magnifications with the same focal length lenses. The main advantage, however, can be in the operating convenience, which is something to be considered if you do much close-up work. A good bellows has two adjusting knobs. One is used to move the entire camera setup closer or farther away from the subject without changing the bellows extension. This knob is used for focusing.

The other knob changes the extension of the bellows, which in turn changes the magnification. So changes in magnification and focusing can be accomplished by simply turning the two knobs with the camera firmly mounted on a tripod or other support. This operation is definitely a convenience that will speed up and give you more enjoyment from close-up photography.

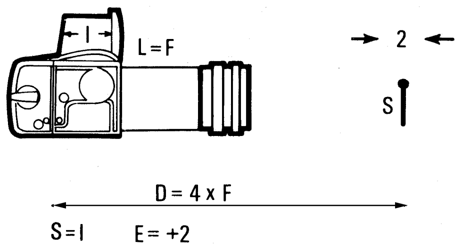


Close-up accessories can be combined. A close-up lens can be added to the front of the lens in addition to an extension tube and bellows between the camera and lens.

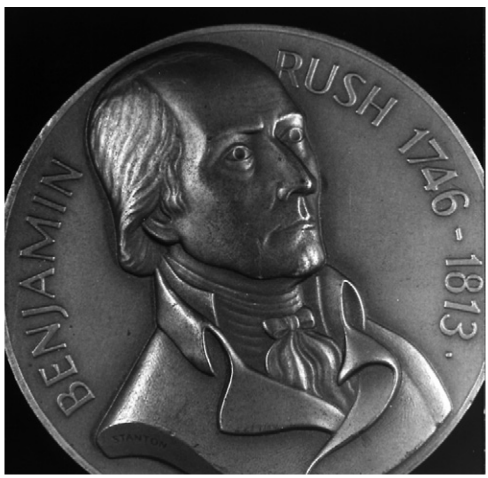
PHOTOGRAPHING SUBJECTS LIFE SIZED

A subject is recorded life sized, in 1:1 magnification, when the lens covers an area that is equal in size to the image format in the camera. This relationship is always accomplished when the length of the extension tube or the extension on a bellows is equal to the focal length of the lens (80 mm with an 80 mm lens, for example).

In life-size magnification, the total distance between subject and image plane is equal to 4× the focal length of the lens (320 mm with the 80 mm lens) Half of this distance is in front of the lens and half is at the rear. Image distance equals subject distance.



Life-size magnification is always obtained when the length of the extension tube or bellows, L, is equal to the focal length, F, of the lens (L = F). The distance (D) from the subject to the image plane is equal to 4× the focal length (D = 4 × F). The exposure increase, E, is always two *f* stops. The depth of field at *f*/11 is about 2 mm.



This life-size magnification image was made with a bellows and an electronic flash.

DEPTH OF FIELD

Depth of field is determined only by the area coverage (magnification) and the aperture (*f* stop) of the lens. Every focal length lens gives the same depth of field at the same aperture if we cover the same area with each lens. Since in most close-up photography the area coverage and the magnification are pre-determined, depth of field can be changed only by opening or closing the lens aperture. The depth of field range is, however, distributed more evenly in front and beyond the focused distance. It is more like 1/2 in front and 1/2 beyond. At longer distances, the distribution is 1/3 in front and 2/3 beyond.

While each lens provides the same depth of field, backgrounds beyond the depth of field range are more blurred with a longer lens. So different focal length lenses can still be used to blur backgrounds more or less.

Depth of field is also not determined or affected by the selected close-up accessory. If extension tubes and bellows seem to produce less depth of field than close-up lenses, it is not because of the equipment but because of the higher magnification.

Since depth of field is determined only by magnification and aperture, you can obtain the depth of field range for any lens from the simple chart below which is based on aperture *f*/11.

DEPTH OF FIELD AT VARIOUS MAGNIFICATIONS

	*Total Depth of Field in mm at f/11**	
Magnification	*A*	*B*
0.1×	100	50
0.2×	30	15
0.3×	15	7
0.5×	6	3
0.8×	3	1 1/2
1×	2	1
1.2×	1.5	0.7
1.5×	1	0.5
2×	0.8	0.4
3×	0.4	0.2

* About half of the depth of field is in front and half behind the set distance.
A: Circle of confusion 0.06 mm (1/400 in.).
B: Circle of confusion 0.03 mm (1/800 in.) for very critical work.

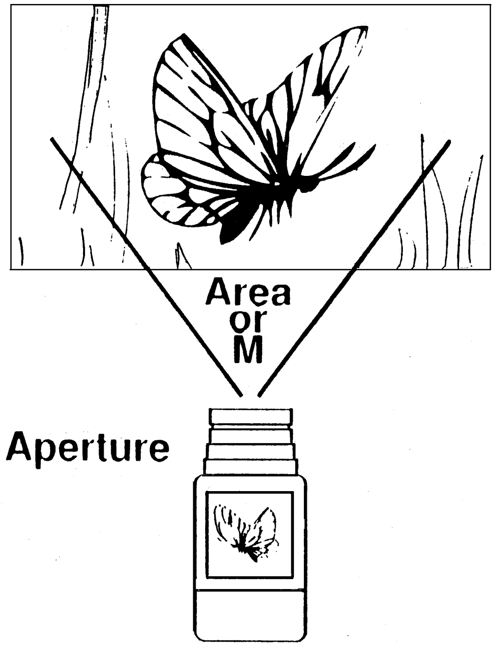
The above figures clearly indicate the limited depth of field in close-up photography and the importance of extreme accuracy in focusing.

To determine the depth of field at other apertures, keep in mind that by closing the aperture two stops, the depth of field becomes about twice as large; by opening the aperture two stops, depth of field is cut down to about half.

EXPOSURE

Correct exposure in close-up photography is determined in the same fashion as at longer distances. Make certain that the meter reading is based only on the small area included in the picture or, in many cases, on a specific part of that area.

A built-in meter measuring the light through the lens and indicating the measured area on the focusing screen has many benefits. A built-in



Depth of field is determined only by area coverage (magnification) and lens aperture. Since the area coverage or magnification is usually pre-determined, depth of field can be increased or decreased only by opening or closing the aperture or covering a smaller or larger area.

spotmeter must be considered the ultimate metering method. With a separate, reflected meter, consider taking a gray card reading. The gray card gives a large metering area and reflects the proper amount of light for correct exposure.

Built-in meters also take the meter reading through the accessory, the extension tubes, or bellows, eliminating the need for considering extension factors. Whatever the meter says should be correct regardless of what lens and close-up accessories you are using.

If meter readings are made with a separate meter, you need to consider the exposure factor for the extension tubes or bellows extension. Exposure must be increased with these accessories because they move the lens farther from the image plane spreading the light over a larger area with the result of less light reaching the image plane.

The necessary exposure increase is based on the ratio between the focal length of the lens and the length of the extension. The increase can be determined from a simple chart, as shown on the next page, which applies to any camera. This chart is helpful when close-up tables are not available.

EXPOSURE INCREASES

Extension ÷ focal length	*Increase in Exposure in f Stops or EVs*
1/10 to 1/5	1/2
1/4 to 1/3	1
1/2	1 1/2
1	2
1 1/2	2 1/2
2	3

For example, a 120 mm lens with a bellows extension of 180 mm will need an increase in exposure of 2 1/2 *f* stops or 2 1/2 EV (180 ÷ 120 = 1 1/2) based on the previous chart.

CHAPTER 14

Filters for Better Image Quality

There are five basic reasons for using filters: (1) to obtain "correct" color rendition on color film or correct gray tones on black-and-white film; (2) to enhance color images or change gray tones in black and white; (3) to create special effects and moods; (4) to reduce the amount of light reaching the film; and (5) to protect the lens.

EXPOSURE INCREASE

Filters absorb light. With light-colored filters (ultraviolet [UV], haze, and some light-balance and color-compensating types), the light loss is so small that it need not be considered in exposure determination. Darker filters, on the other hand, take away a sufficient amount of light to affect exposure. As a result, you need to adjust lens settings unless you take the meter readings in the camera with the light measured through the lens and filter. The built-in meter readings are correct for most filters.

When using a separate meter, you need to make an adjustment in the exposure settings based on the information from the filter manufacturer. Some companies provide the necessary increases in filter factors, others in apertures. It is important to know which figure is on the chart so you know how much to adjust the aperture or shutter speed.

The chart on the next page shows filter factors and equivalent *f* stop values. The exposure correction shown in the chart can be made either by multiplying the shutter speed by the filter factor or altering the *f* stop or EV setting by the indicated aperture increase. For example, with a 4× (or +2 stop) filter, change from EV 13 to EV 11 or from *f*/11 to *f*/5.6.

FILTER FACTORS AND *F* STOPS/EV

Filter factor	1.5	2	2.5	4	6	8	16	32	64
Increase in exposure in *f* stops or EV	1/2	1	1 1/2	2	2 1/2	3	4	5	6

FILTERS AS LENS PROTECTION

Lenses are the most expensive components in a camera system. They are also the components that are most easily damaged and probably the most expensive to repair. A simple way to protect the front lens element is with an optically plain piece of glass, which is easy to clean and relatively inexpensive to replace. An ultraviolet or haze filter can serve this purpose. These filters do not change the colors or gray tones noticeably and do not require a change in exposure.

Each of your lenses should be equipped with a filter. It is too time consuming to switch filters from one lens to another every time you change lenses. Since the filter becomes somehow a permanent part of the lens and all pictures are taken through this additional piece of glass, the filter must be made to the same degree of perfection as the lens. For color photography, use the same type filter made by the same company on every lens to avoid possible differences in color rendition. A lens shade over the lens is highly recommended for the best possible contrast and further protection against possible damage to the lens. A lens shade also prevents snow or rain from falling on the lens element.

HAZE AND ULTRAVIOLET FILTERS

Haze and ultraviolet (UV) filters can be helpful for eliminating UV rays when photographing at high altitudes or other places where large amounts of UV rays exist. They can do this without changing colors to a noticeable degree. Most modern lenses, however, have some lens elements made from types of glass that absorb UV rays and may do so to a higher degree than a UV filter. We can say that such lenses have built-in UV filters. This also explains why these filters are no longer necessary for general photography. In spite of the name, UV and haze filters do not eliminate haze and do not improve distant shots.

NEUTRAL DENSITY FILTERS

Neutral density filters, also called gray filters, are used in both black-and-white and color photography. Made from neutral gray colored glass, the neutral density filter is designed to reduce the amount of light reaching the image plane without changing the tonal rendition of various colors. Neutral density filters come in different densities requiring the following compensating increases in exposure:

NEUTRAL DENSITY FILTERS

Density	*Percentage Light Transmission*	*Increase in Exposure in Exposure Values or f stops*
0.3	50	1
0.6	25	2
0.9	12	3
1.2	6	4
1.5	3	5
1.8	1.5	6

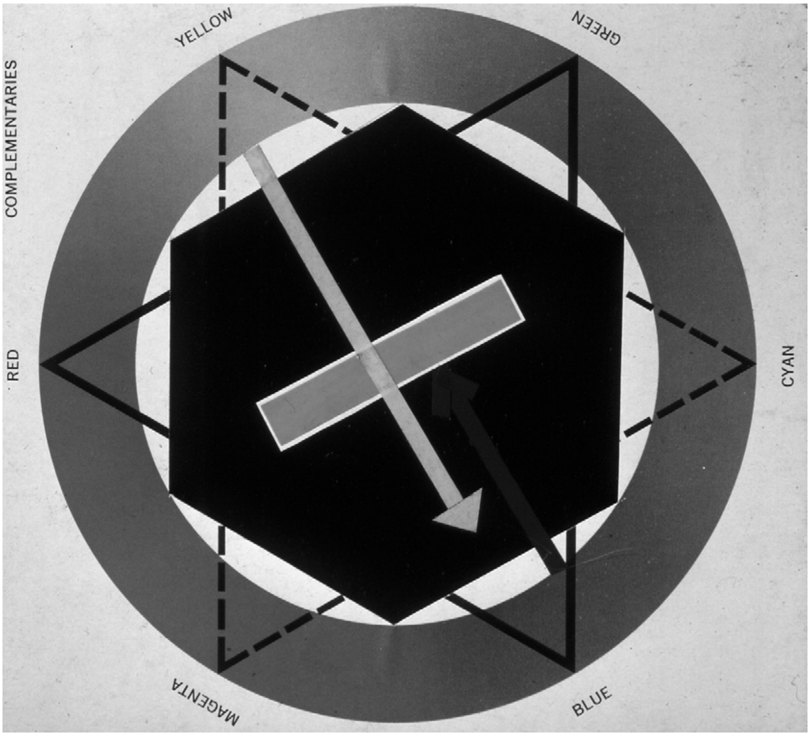
Neutral density filters can be combined. To obtain the total density, add up the densities of each filter; for example, the 0.3 and 0.6 filters combined have a density of 0.9.

Neutral density filters can be used outdoors with color or black-and-white films when the sunlight is too bright to permit photography at large apertures with shallow depth of field or to allow slow shutter speeds for blurred motion or zoom effects. Neutral density filters can also be used to compensate for different film sensitivities. The most valuable application is for matching the sensitivity of the film used for the picture with that of the Polaroid film used for the test. Such matching allows you to use the same aperture and shutter speed combination for both.

FILTERS FOR BLACK-AND-WHITE PHOTOGRAPHY

In black-and-white photography, colors are recorded in a range of gray tones from white to black. Filters are used for darkening or lightening certain colors to emphasize, suppress, separate, increase, or reduce contrasts. You can lighten or darken any color. The color of the filter determines what happens to what color. The degree of the color change is determined by the density of the filter. The color wheel makes it easy to determine the effect of filters in black-and-white photography. To lighten a color, use a filter of the same color or at least from the same side of the color wheel. To darken a color, select the color directly across the wheel or at least from the opposite side. A yellow filter darkens colors from blue-green to violet. Green filters lighten green and darken purple and red.

In black-and-white photography, a yellow filter produces some improvement in distant shots, but orange and red filters are more effective. Complete or almost complete haze penetration can be obtained with a red filter combined with infrared film, but other colors also change; for instance, green appears as white.



Subjects that have the same color as the filter or are on the same side on the color wheel will be recorded lighter. Those having a color on the opposite side of the wheel will be recorded darker. A yellow filter (shown) darkens blue.

COLOR QUALITY OF LIGHT

Color transparency films are manufactured for a specific color temperature, and correct color can be obtained only if the color of the light matches that for which the film is balanced. The color quality of light, its color temperature, is expressed either in Kelvin or in decamired values. Kelvin and decamired values are directly related by the formula

$$\text{DM value} = \frac{100{,}000}{\text{Kelvin value}}$$

Daylight color films used in medium format photography are matched to daylight of 5600° Kelvin (18 DM). Tungsten type is balanced for 3200° K (31 DM) The following chart shows the Kelvin and DM values for some typical light sources. To determine the color temperature of an unknown light source in critical color photography, use a color temperature meter.

COLOR TEMPERATURE OF TYPICAL LIGHT SOURCES

DM	*Kelvin*	*Type of Light*
8	12,500	Shade with clear blue sky
16	6,250	Overcast day
17	5,900	Electronic flash
18	5,600	Sunlight at noon
29	3,450	Photofloods
31	3,200	Tungsten lamps
34	2,900	100–200 W household lamps
36	2,800	40–75 W household lamps
54	1,850	Candlelight

FILTERS FOR COLOR PHOTOGRAPHY

Light Balance and Conversion Filters

Light balance and conversion filters are used in color photography for matching the color quality of the illumination to that of the film, or to obtain a warmer or cooler color rendition in the image. Light balance filters are used for minor adjustments, conversion filters are used for a more drastic change.

The filters that have a warming effect are the decamired red types (CR), the 81 series light balance and 85 conversion types. They are used when the light is too blue for the film in the camera. The filters with cooling effect are the decamired blue types (CB), or the 82 series light balance and 80 conversion filters. These cooling filters are used when the light is too red.

The proper or suggested filter is obtained from the chart below. For critical work or when working with an unknown light source, consult the reading on a color temperature meter.

FILTER VALUES REQUIRED IN VARIOUS CONDITIONS

Purpose	*Decamired Filters*	*Wratten Filters*
For warmer rendition with some electronic flash units (some units produce a bluish light)	R 1.5	81A
To reduce warm tones in early morning and late afternoon photography	B 3	82B
To use Tungsten type color film in daylight	R 13.5	85B
To use daylight film with 3200 K light	B 13.5	80A
To use daylight film with 3400 K light	B 12	80B
To use Tungsten type film with 3400 K light	R 1.5	81A
When using Tungsten type film with household lamps	B 3	82C

Slight warming filters such as 81A or 81B (R 1.5 or R 3) used to be recommended for all color photography outdoors on overcast days or to reduce the blue in shaded areas. The color films that we have today have been improved to a point where I have not found the need for using these warming filters. Make your own tests.

Color-Compensating Filters

Color-compensating (CC) filters are available in six colors (yellow, magenta, cyan, red, green, and blue) and in different densities in each color, from about 0.05 to 0.50. These filters are most readily available in gelatin. One of their main applications used to be for compensating for variations in the color balance of professional films. The necessary correction used to be indicated on the specification sheets for professional films. Today, this is no longer the case because films are balanced to a much higher degree.

Some other applications for such filters are in underwater photography, photographing through tinted windows or under fluorescent lights, and general adjustments in the color rendition.

Special Filters for Fluorescent Light Sources

The light from fluorescent tubes is not evenly distributed through the spectrum, so the quality of photographs taken under fluorescent light with color film can be unpredictable. Film and fluorescent tube manufacturers publish charts showing which color-compensating filters produce the most satisfactory results. Special filters for fluorescent lights are also available, usually one filter for daylight film and another for Tungsten type.

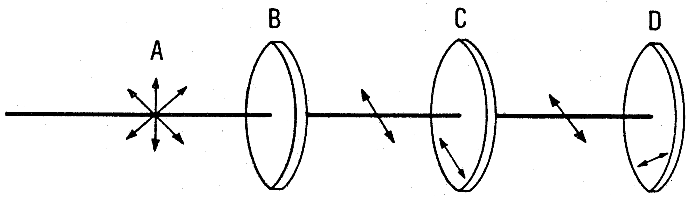
POLARIZING FILTERS

Light that reaches our eyes or the camera lens directly is usually unpolarized, meaning that the light waves vibrate in all directions perpendicular to the light path. If such light reaches glass, water, or many other reflecting surfaces at an angle, mainly between 30° and 40°, it becomes polarized; the resulting light waves vibrate in one direction only.

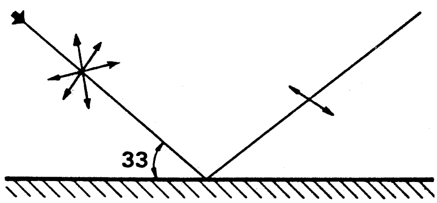
Polarizing filters are made from a material that changes natural into polarized light. If the light reaching the polarizing filter is already polarized, the filter can either let the polarized light pass through or absorb it, depending on how the filter is rotated in relation to the polarized light that reaches it.

A polarizer is an outdoor photographer's most important filter with a wide range of applications beyond just darkening blue skies. A nice aspect in using polarizers is in the fact that you can see the effect. By rotating the filter in front of the lens while evaluating the image on the focusing screen in the SLR camera, you can see what happens to the image. You can see, for example, whether the filter darkens the sky and to what degree. You don't even need to use the camera for that purpose.

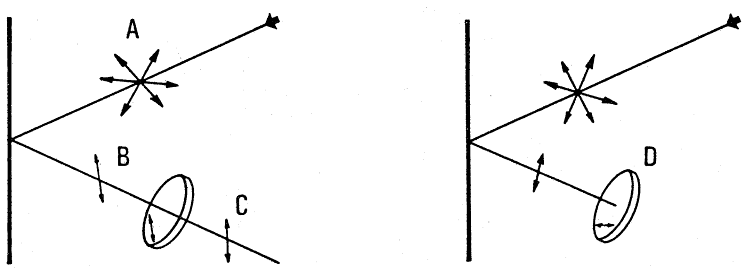
Simply rotate the filter in front of your eyes while looking in the direction you plan to take the picture.



Natural, unpolarized light (A) vibrates in all directions. As it passes through a polarizing filter (B), the light becomes polarized; it vibrates in one direction only. If this polarized light meets another polarizing filter (C) with its axis of polarization in the same direction as the first, the light passes through. A polarizing filter with its axis of polarization at right angles (D) to the first absorbs the light. This arrangement is called *cross-polarization*.



Surfaces can polarize natural light that reaches the surface at a specific angle usually around 30° to 40°.



Polarized light reflected from a surface passes through a polarizing filter with its axis of polarization in line with the reflected light (left), but not through one positioned at right angles (right). Reflections are eliminated.

Polarizing Filters for Darkening Blue Skies

For many photographers, the main or only known use for a polarizing filter is for darkening blue skies. A polarizing filter can darken the sky, even if it is not blue, on color or black-and-white film but only with

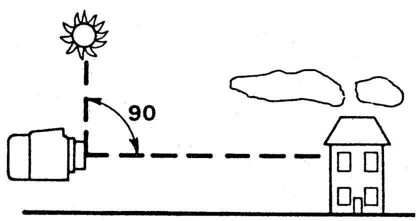
sidelight. The sunlight must come from the side; otherwise nothing happens regardless of how you turn the filter. With sidelight, the improvement can be rather drastic, sometimes to the point where the sky becomes too dramatic and unnatural. The effect can be reduced by not turning the filter all the way to the point where it produces the maximum darkening. Polarizing filters offer the only method for darkening a sky on color film. Yellow, orange, and red filters can do the same in black-and-white if the sky is blue.

Polarizing Filters for Improving Distant Shots

The polarizer is the only filter that can improve distant shots in color photography and should be used much more often for this purpose because the improvement can be very dramatic. I must assume that many photographers are not aware of this possibility.

Distant shots again can be improved only with sidelight, but the polarizer not only eliminates or reduces haze, but also reduces the objectionable bluish cast. Haze and UV filters do not provide this improvement.

Distant shots in black-and-white can be improved with orange or red filters—drastically improved to the point of perhaps looking unnatural in combination with infrared film.



Polarizing filters darken skies and improve distant shots only with sidelight. With front or backlight, the polarizing filter has no effect.

Polarizing Filters for Eliminating Reflections

Since the light reflected from most surfaces, except bare metal, is polarized, a polarizing filter can eliminate or reduce reflections from store windows, water, rain covered streets, wet leaves, grass, or from glossy photographs, paintings, pictures under glass or in any type of copying. When you reduce reflections, you increase color saturation, so polarized images have a higher contrast.

Such reflections are not reduced or eliminated when photographing the subject straight on, from 90° to its surface. They are reduced or eliminated only when the subject—the window, for instance—is photographed at an angle, with the maximum reduction when photographing from an angle of 30° to 40°, depending somewhat on the type of surface.

While reducing or eliminating reflections is very desirable to improve the color saturation and contrast of the image, it can also be undesirable. Some reflections are very natural for some subjects, for example, on porcelain and silver. Images of water surfaces can be changed drastically with a polarizer, but you need to watch the effect before you decide to use the filter. The reflections from a blue sky add life and beauty to water surfaces. Eliminating them can make subjects appear dull and uninteresting.

A polarizing filter eliminates or reduces reflections only when you photograph the subject with the reflecting surface (the store window, in this case) from an angle.

Polarizing Filters for Copying

In copying or photographing art, charts, book pages, old photographs, you must photograph straight on to avoid keystoning. In such cases, a polarizing filter on the lens alone is of no benefit. It improves the results only if you also place polarizers over the light source or light sources so that the light reaching the subject is already polarized. This process is described in more detail in the section on copying.

Light must also be polarized to eliminate reflections from bare metal.

Reflections on water surfaces usually add life, color, and beauty to such images (left) so you may not want to eliminate them with a polarizing filter (right).

Technical Points About Polarizers

As polarization depends on the angle of reflection, the polarizing effect may not be the same over the entire image area, especially when you are using wide angle lenses. A blue sky may be bluer at the bottom than at the top, or bluer on the left side than on the right. Such differences can be visible in the viewfinder, so evaluating the image carefully before shooting is good advice.

Polarizing filters require an increase in exposure because the polarizing material is not clear but has a grayish tint, somewhat like a neutral density filter. The increase is usually one or one and a half *f* stops. Check the instruction sheet. The required increase is the same regardless of how the filter is rotated—whether to the position of minimum or maximum polarization. Images made with a polarizing filter, however, sometimes appear darker even if the exposure has been increased as specified. This apparent darkening is caused because the reflections that made the subject appear brighter have been eliminated. It is not the result of wrong exposure. If there are reflections over a large area of the subject or scene, an additional half stop increase in exposure may give you better results.

Exposure meters built into cameras may or may not give the correct lens settings when the light is measured through an ordinary linear polarizing filter. It depends on the meter design in the camera. Check with the manufacturer or make your own tests. Such a linear polarizer may also affect the operation of an automatic focusing system. If the linear polarizer causes this problem with the meter or focusing, a circular polarizer must be used.

Although polarizing filters look like neutral density filters, some filters may cause a slight change in color rendition. Such a change becomes visible mainly when you compare two pictures, taken in the same location with the same light, but one with and one without the polarizing filter.

PARTIAL FILTERS

Filters that are clear over part of the area, and neutral gray or colored over the other part can be very helpful for improving an image or for creating a special effect. Neutral density filters can be used to darken some areas while leaving other areas undisturbed. A typical and helpful application is for darkening bright skies. You can change colors in some areas with color filters while leaving other areas unfiltered.

Partial filters must be square and mounted in a square filter holder so you can move them vertically or horizontally. Some special lens shades available for medium format cameras offer this possibility. When positioning the filter, you need to view the focusing screen image and view the image at the lens aperture that you plan to use for the picture, or even better, determine the aperture that produces the desired results while manually opening and closing the diaphragm. The sharpness of the dividing line between the filtered and nonfiltered area and its position within the image depend on the aperture setting.

If the filter darkens or changes the color over the main subject area, you need to consider the filter factor in determining exposure. If the filter is used to darken or change the color over a secondary area such as the sky, you don't need to consider the filter factor. In such a case, the main part of the image—the landscape below the sky—is not affected by the filter, so your lens settings are based on the regular meter reading of the unchanged area.

QUALITY OF FILTERS

Filters used with high-quality lenses must be made to the same quality standards as the lens. This is important for more critical work done with a medium format camera, and especially for filters that are used for all or most of the images such as haze and UV types or when you combine filters. Only the best quality filters of any type should be considered in combination with long telephoto lenses. A poor quality filter can produce a drastic reduction in the image quality and even affect the focusing accuracy of a telephoto lens.

FILTER MAINTENANCE

Glass filters are cleaned like lens surfaces, by blowing or brushing off dust. Clean them with lens tissue and lens cleaner only if necessary. Never use lens cleaner or any other chemical solvent for cleaning filters made from acrylic materials. A soft brush or blower will remove dust. Grease or finger marks can be removed with a soft polishing cloth, if necessary, after you breathe on the filter surface. Avoid unnecessary brushing and cleaning. Place a lens cap over a filter on the lens and store loose filters in some kind of a case.

CHAPTER 15

Digital Imaging in the Medium Format

Until recently, photography always meant recording images on transparency or negative film, then projecting the slides on a projection screen, or producing black-and-white or color prints from the negatives in the darkroom. Most special effects such as changes in color, multiple exposures, and blurred motion had to be created when recording the image.

Today, we also have the possibility of recording the images electronically, viewing them on a computer or TV screen, producing prints without a darkroom, or sending the images without delay over the Internet. Such images can also be retouched or changed afterwards; unlimited special effects can be added electronically. Much of the photojournalistic work and large volume catalog photography is done today completely without film.

As a third option, we can record the images on film in the camera as we have done up to now, then produce prints or transparencies electronically either as they were recorded in the camera or after retouching, changing, improving, or combining them with other images electronically. Since any image recorded on film can be transformed into a digital image, this is presently the approach used by most professional photographers in the commercial, fashion, and architectural field.

THE NEW POSSIBILITIES

Electronic imaging has greatly enhanced the after-exposure possibilities. You can now improve images recorded in any camera, with film or

digitally. With electronic retouching, you can change colors, eliminate distracting elements, add elements, combine different images, change parts of an image, or change images completely. You can improve images technically; for instance, you can straighten out the slanted verticals of a building. The possibilities are limited only by your own imagination.

All these possibilities, however, should not be considered as a replacement for image control in the camera. The new possibilities for retouching images may perhaps bring the danger of some photographers becoming less careful and critical when recording the image in the camera, thinking and hoping that things can be changed and improved afterwards. I still recommend that you spend your time in careful image evaluation when you take the picture and that you try to record a visually perfect image in the camera whenever possible. The slanted verticals in a building, for example, can be straightened out with PC lenses, PC teleconverters, or the shift control in some medium format cameras in a fraction of the time it takes to do it afterwards on the computer.

There are, of course, situations when we do not have the time or the opportunity to completely evaluate the image and the composition. In such cases, the possibilities for improving the image afterwards offered by electronic imaging are appreciated even if the improvement involves nothing more than eliminating a distracting element.

You do not need to make these electronic improvements, manipulations, scanning, and digital printing yourself. Laboratories and service bureaus that can do all this work exist in all major cities.

Electronic imaging is a fascinating addition to photography, and we have the wonderful opportunity of creating images photographically or electronically, or combining the two in many different ways. It is completely up to us to decide to what extent it should be a part of our photography.

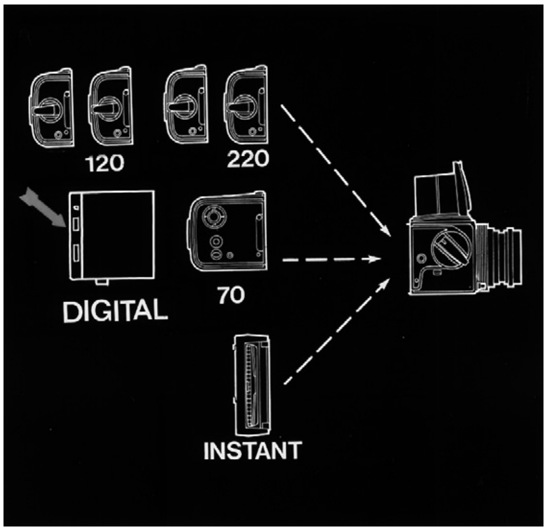
While electronic imaging has added a completely new dimension to photography and makes the creation of visuals so much more exciting, my own choice is still to create images in the camera as perfectly as I can so that they do not need any changes afterwards except possibly changing the image format. I also want to show things as they are, not as I think they should be. In fact, I hope that my images show the subjects and scenes that I photograph more beautifully and more effectively than most people see them. Since I do not need the images instantly, my own choice is still for the beautiful and incredibly sharp films that are available today for medium format cameras.

Some photographers feel that electronic imaging will replace film photography completely. Perhaps so in the far future, but this is also questionable since there are many advantages to recording images on color or black-and-white film. Electronic imaging may never replace film photography but must be considered a wonderful addition to film photography, offering new and exciting possibilities that would be impossible or difficult to achieve with film alone.

Whether to change to electronic imaging or add electronic imaging to your present photographic involvement must therefore be a question that the working photographer must answer.

SELECTING DIGITAL EQUIPMENT

When considering digital equipment for your work, you must determine beforehand what it will be used for and especially what size prints you need for that application. Then check the specifications, or even better, actually try using the equipment in a typical application and make prints in the size you need. This suggested approach is the same as for film photography—selecting a certain film format and/or piece of equipment best suited for a specific application. You probably will not decide on 35 mm if you need gigantic enlargements but shoot the original in the medium or large format that provides the necessary sharpness for the blow-up.



Digital backs can be attached to some medium format cameras in place of magazines for various film types or formats. The same camera, lenses, and accessories can then be used for film photography and electronic imaging.

Digital Recording in the Medium Format

Digital recording is closely associated with the medium format and has become an important part of imaging with medium format cameras. Various medium format cameras can be equipped with digital backs in place of the standard film magazine. There is no need to invest in a completely new camera system for digital imaging. You can use the same camera and all the lenses and accessories for digital imaging as well as for film photography. If digital applications only come up occasionally, you can probably even rent the necessary digital back for that particular job.

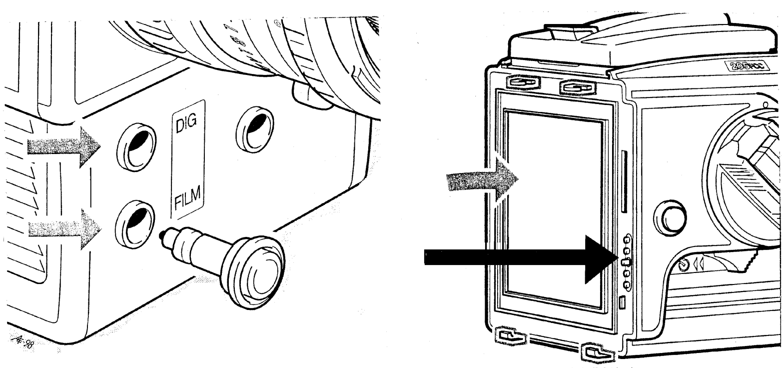
As with all camera equipment, you must study the specifications for the digital back. Some are only usable with specific camera models even among those made by the same company. You may need a motor-driven camera, and you may have to be directly connected to the

computer, limiting the photographic work to the studio. Other digital backs can be taken into the field recording the images on a PC card. You must also check whether the image is scanned or recorded instantly in all colors. The latter will allow photographing moving subjects and the use of electronic flash. Most importantly, check the specifications of the electronic sensor that records the image, which can be a Charged Coupled Device (CCD) or a Complementary Metal-Oxide Semiconductor (CMOS). At present, chips in high-quality digital backs are listed with pixel counts of about 2000 × 3000. By the time this book is published, such chips with a 4000 × 4000 pixel count may be available, producing images that match, or even exceed the sharpness of images made from film. A 4 × 8 ft. blow-up from an image made with one of these latest chips has been exhibited at photo shows.

Since electronic imaging technology is changing rapidly, and new and modified products are introduced constantly, I do not discuss the presently available products in more detail in this book. The information would likely be outdated by the time the book comes on the market. Find out what is available when you are ready to go into this field of electronic imaging.

Digital Camera Operation

While digital recording has some special requirements, the basic camera operation is done in the same fashion as with film. Most of the information in this book, such as the use of lenses, lens controls, close-up photography, use of flash, compositions, and practically everything else, also applies to electronic imaging with these cameras. The use and operation of lenses and lens controls is also identical. However, the focal length of lenses may take on another meaning in regard to what is considered a standard, wide angle, or telephoto lens.



Medium format cameras may have special features for electronic imaging such as a special camera release (left) and electronic couplings from the camera to the electronic back (right) that eliminate cable connections.

SELECTING LENSES FOR ELECTRONIC IMAGING

While medium format cameras can be used for electronic imaging in combination with a digital back, you must realize that the CCD or CMOS sensor in most digital backs is much smaller than the medium format image. They are closer to the size of a 35 mm frame or somewhat larger. Therefore, the angle of view and area coverage of the lenses is much different. The standard lens for the medium format becomes a telephoto in digital recording. A 50 mm focal length, which is a wide angle in the medium format becomes the standard focal length in digital recording. You will undoubtedly have a great need for wide angles and extreme wide angle lenses when you use the medium format camera for electronic imaging.

Lenses on cameras made strictly for digital recording are usually engraved with their actual focal length. The specification sheets for such cameras, however, frequently do not show the actual focal length, but the focal length or range of focal lengths on zoom lenses that cover the same area as on a 35 mm camera. The sheet may read "equiv. 38 to 86 mm on 35 mm." The actual focal length range of such a lens may be 8 to 18 mm. This is a very logical approach since the size of the image-recording area varies greatly among cameras, specifically in point-and-shoot types.

Lens Quality and Performance for Digital Photography

Since the general conception still exists that the sharpness of digital images is not up to the standards of high resolution films, one might get the impression that lens quality is not too important for digital work. That is correct for point-and-shoot digital cameras as it is for point-and-shoot film cameras, where images are seldom enlarged to more than 4×6 inches (10×15 cm).

For any other digital application, especially when working with a digital back on a medium format camera, it is worthwhile to study the facts a little closer—if only because the quality of digital images, which is already exceptional, will undoubtedly improve, perhaps drastically.

At present, a camera lens that produces a good image quality on film can also be expected to produce good sharpness when used for digital work, at least in travel, news, fashion and documentary applications, and for catalog work. This certainly applies to the higher quality lenses usually sold for medium format cameras and is especially the case since the CCD or CMOS sensor in most digital backs uses only the center portion of the usable image circle of the medium format camera lens.

However, lenses for high quality digital photography have some of their own requirements, especially if the photography is done on a large format camera or with a digital back on a medium format type. Due to the pixel dimension, lens resolution should be targeted to the higher line pair frequencies. The lines for 20 or 40 lines per millimeter (Lp/mm) spatial frequencies on MTF charts must be considered more seriously. Quality digital images also need excellent sharpness without color fringes all the way into the corners.

Since digital photography in the advertising field usually means close-up photography, the lens must be capable of producing this high resolution at close distances. Color correction must be of the highest level. Differences are easily visible when switching between the three-color separations in Photoshop.

In many cameras today, the sensor has a higher light requirement than film, so it is desirable to obtain the highest quality images at larger lens apertures. Large format lens manufacturers have introduced special lenses for digital photography, which produce the highest resolving power and contrast at $f/8$ or $f/11$ (not $f/22$, normally used for film). Lens designers also pay great attention to achieving excellent image field flatness since the image sensor is perfectly flat, more so than the film surface in any camera.

While sharpness filters in imaging software can upgrade an image and sharpen the edges, they cannot bring in details if they don't exist on the original.

CHAPTER 16

Applications and Specialized Fields of Photography

Medium format cameras are excellent for just about every photographic application. The large negative size combined with camera portability is one reason. The extensive interchangeability of components combined with the wide range of accessories available for many camera models is another.

Each field of photography and each application has its own requirements. Some camera types are undoubtedly better suited for some applications than others. Some types of photography are simplified by certain camera features, or accessories; other types may require special accessories. It is, therefore, worthwhile to make the choice of a medium format camera a personal one, while carefully considering the type of photography you will be doing.

WILDLIFE AND BIRD PHOTOGRAPHY

Long focal length lenses combined with an SLR camera are a must in wildlife and bird photography. A built-in meter is helpful for determining the light level at distant areas. A motor drive is a great help, especially when you are following birds or animals. If you want the bird or animal to trigger the camera, a motor-driven camera that can be released from a distance is a necessity. Black cameras and black lenses are less

noticeable than the more reflective chrome-trimmed models. Camera noise should also be considered.

Most medium format cameras are excellent for special applications as well as for news and documentary coverage. Even with longer lenses, fast, handheld photography is possible. The larger negative offers great possibilities for cropping into the important part of the negative.

NATURE PHOTOGRAPHY

Nature photography can include anything from scenics to extreme close-ups, the latter usually constituting the large portion of nature subjects.

Nature close-up photography frequently involves recording moving subjects. Your setup time may be limited, and you must be prepared to move fast. Handheld close-up photography may be necessary. All close-up accessories, even bellows, can be used handheld.

The necessary camera and accessory equipment are determined by the size of the area to be photographed. SLR cameras are a must. Built-in light meters simplify exposure. A mirror lockup is another must because exposure times are often fairly long.

OUTDOOR SCENERY

Most outdoor photography is shot at medium and long distances; thus just about any camera can serve the purpose. The choice of lenses is not

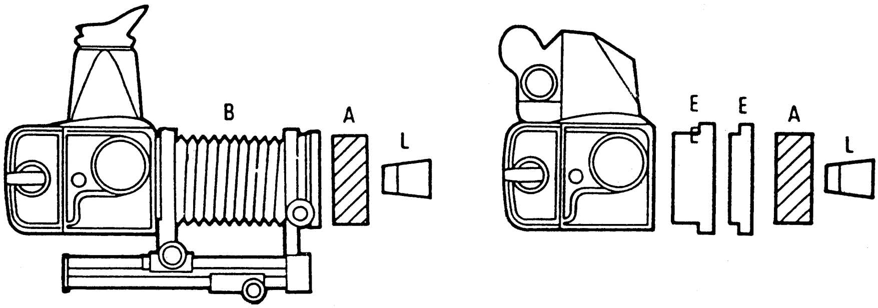
so much determined by the photographic technique as by personal choice. Some photographers like to concentrate on patterns, lines, shapes, and small areas that require long lenses. Others like to enhance the space, the relationship between close and far, with wide angles. For a spectacular presentation of the outdoor space, a panoramic camera can offer exciting possibilities.

Nature photography calls for the SLR camera type that allows accurate framing and focusing at all distances and with all lenses and close-up accessories.

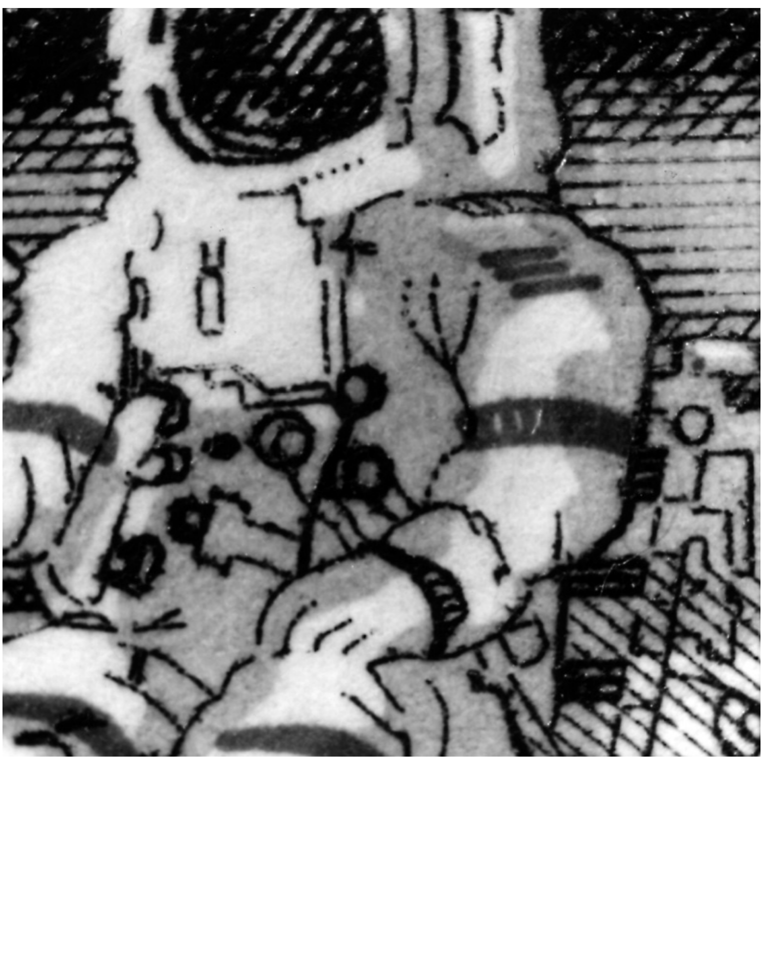
HIGH MAGNIFICATION PHOTOGRAPHY

High magnification means photography using magnifications 2× or higher. For magnification up to approximately 20x, special lenses in combination with a bellows between camera body and lens should be selected. The special lenses, which look like objectives for a microscope but are optically designed for use without an ocular, are available from various microscope manufacturers. Each lens has a standard male microscope thread for mounting the lens on the camera or bellows using a special mounting plate.

High magnification photography requires a lot of light. Electronic flash is by far the most satisfactory light source—bright, short, and cool. With electronic flash, a camera or lens shutter is not really necessary. Work in a dark area. Use the open flash method. Set the lens or camera shutter on B, depress the release, and fire the flash. Correct exposure is best determined with a Polaroid film magazine.



Special objectives for high-magnification photography from about 3× to 25× (L), can be used on SLR cameras with interchangeable lenses. The objective is mounted into a board (A) that fits into the bellows (B) or extension tube (E). The bellows is recommended, as it offers a range of magnifications, as well as a convenient method of focusing.

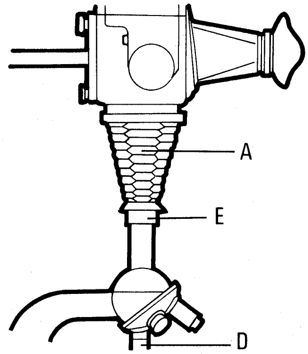


Here is an example of the possibilities with high-magnification lenses. The photo above shows a 2× magnification of a postage stamp and the photo on p. 216 shows a detail out of the stamp with a 10× magnification.

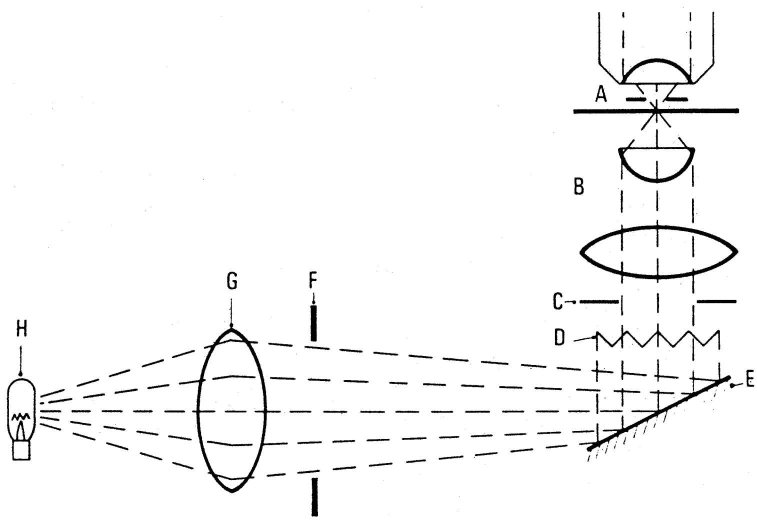
PHOTOGRAPHY THROUGH THE MICROSCOPE

For higher magnifications, the medium format SLR camera can be combined with a compound microscope, which consists of an objective and an ocular (eyepiece), which magnifies the image created by the objective. Usually you mount the camera without the lens over the microscope, using a separate stand. A light-tight connection between camera and eyepiece (microscope adapter) is necessary. A mirror lockup is even more important than for general close-ups. A motor drive also reduces the possibility that the camera will move and disturb the delicate microscope setup while the film is advancing.

A built-in meter can provide exposure information for photomicrography if the image is bright enough. Some separate meters have special attachments for this purpose. The best and most accurate approach is to use the Polaroid film magazine to make test shots.



In photomicrography, the eyepiece (E) forms the image, so no camera lens is used. The microscope adapter (A) holds the eyepiece and shields the camera from extraneous light. The eyepiece is dropped into the microscope adapter, and the adapter is then attached to the camera like a lens. The microscope objective is shown at D.



Proper illumination is the most important step to successful photomicrography. The recommended specimen illumination is obtained by first centering the lamp and then changing the distance between the lamp (H) and the condenser lens on the lamp until a sharp image of the filament is recorded on the back surface of the stopped-down substage diaphragm (C). Stop down the field diaphragm (A), and adjust the position of the substage condenser (B) until a sharp image of the field diaphragm appears on the focusing screen of the camera. The image of the field diaphragm is then recorded in the specimen plane. The field diaphragm is opened just enough so its image fills the entire diameter of the objective lens.

AERIAL PHOTOGRAPHY

Medium format cameras are an excellent choice for aerial photography, either with the camera built into the aircraft or with a handheld camera. Motor drives are highly desirable or essential.

There are arguments about appropriate shutter speeds. Some photographers feel that 1/500 or 1/1000 second is sufficient; others will insist and prove that a 1/2000 second speed provides sharper results. You certainly could not go wrong using the 1/2000 or 1/1000 second shutter speed for any aerial applications.

An SLR-type camera is not necessary, but if you use one, it must have a prism or frame finder so you can view from behind the tilted camera. Interchangeable film magazines are a must, and a larger capacity 70 mm film magazine is very desirable because it reduces the number of magazine changes. For multispectral photography, two to four motor-driven cameras are used. They must be connected to a camera release so all cameras release at the same time. Some wireless remote controls offer the possibility of multiple camera operation.

Good image contrast is necessary for quality aerial photography. Contrast can be achieved in color and black-and-white mainly by using the daylight properly. Avoid flat lighting. Try to obtain images with shaded and lighted areas by photographing when the sun is low. Sidelight is best in most cases. Yellow, orange, and red filters can help in black-and-white work. A polarizing filter would help in color but is not practical because it would need to be rotated constantly as the plane or helicopter changes direction.

ARCHITECTURAL PHOTOGRAPHY

Quality is vital in architectural photography, so the choice of lens is most important. Retrofocus-type wide angle lenses on an SLR model are fine, but for even better corner-to-corner sharpness and less distortion, consider a special medium format wide angle camera equipped with an optically true wide angle lens. A spirit level, built into the camera or as an accessory, is helpful. Perspective control (PC) lenses, PC teleconverters or a special medium format camera with shift capability can offer at least some of the possibilities provided by a large format camera with swings and tilts. A Polaroid back is highly desirable so you can make test shots for checking the evenness of illumination and lighting ratios, and detecting troublesome reflections.

WEDDING PHOTOGRAPHY

Since you carry your camera constantly for three or more hours when photographing a wedding, size, weight, and convenience of carrying must be the first considerations. But otherwise almost any type of medium format camera can be used in this field. Film format is the last consideration. Wedding photographs in an album or displayed in any other way are equally beautiful as squares, ovals, or rectangles.

Flash synchronization at all shutter speeds is important for flash-fill outdoor work. A camera with a built-in dedicated flash system simplifies flash photography and provides consistently good exposures automatically. The dedicated flash camera system must allow reducing the flash exposure at least to –2 stops, preferably to –3.

Your equipment should be simple: two lenses and perhaps a close-up accessory for photographing hand and ring shots are sufficient. A popular lens is a slight wide angle with a horizontal angle of view of about 50°. This lens allows full-length bridal shots even in small rooms. A zoom lens with the appropriate focal length can allow you to photograph the entire wedding with one lens.

FASHION AND BEAUTY PHOTOGRAPHY

Beauty photography is studio work and frequently means tight head shots and shots of hands and legs, all of which can be done with a regular portrait lens 120 to 200 mm. Longer telephotos are also popular. Their longer shooting distance compresses perspective and brings out the eyes, lips, and cheeks, which are important in beauty illustrations.

Fashion photography is almost equally divided between studio and location work, and between tripod and the handheld approach. Motor drives are very helpful because they allow you to keep the eye constantly in the viewfinder. You never lose contact with the model, and you can shoot additional pictures the moment the expression or pose changes. A remote release allows you to be close to the model for easier communication. Professional models are expensive, so speedy shooting without time-consuming film loading is essential. A Polaroid magazine allows the client or art director, who is usually present during the shooting, to see and approve the results.

A good sunshade is essential in the studio because much of fashion and beauty photography is done against white backgrounds. Image sharpness is a main requirement for magazine cover shots. Beauty photography is a competitive business, so you cannot compromise on quality.

PORTRAIT PHOTOGRAPHY

Portrait photography can be studio or location work and full-length, three-quarter, or head and shoulder shots. Portrait work is best done from a tripod, because it helps the photographer better communicate with the people and direct the model. A pre-release mirror lockup must be used because exposure times are relatively long, especially in shaded locations outdoors. Portrait work usually means shooting negative film and making extensive use of diffusion devices or soft focus lenses. The same compact medium format camera makes a superb tool for portrait photography in the studio as well as on location. Photographing from a tripod makes it easier to direct the model.

The same medium format camera can make a superb tool for fashion and portrait photography whether it is done on location or in the studio. My personal choice is for a touch of softness for such portraits and I use a Carl Zeiss Softar filter #1 for that purpose.

CHILD PHOTOGRAPHY

Although any "portrait camera" is suitable, many of the top child photographers prefer to work with motor-driven types and with remote release capability, so they need not stand behind the camera. A remote release allows you to stand next to the child, perhaps using a toy to get that precious expression, which is so important in child photography.

In the studio, light-colored backgrounds are more likely to convey the happy mood related to childhood. The high-key approach with the subjects dressed in light-colored clothing photographed against a white background without shadows is popular. Location portraiture showing the child in a natural surrounding offers great possibilities for natural looking images and also puts the children more at ease.

SOFT FOCUS PHOTOGRAPHY

The soft focus approach can add a glamorous touch to portraits and bridals, to advertising images of beauty products or anything else associated with beauty and romance, while at the same time reducing the need for retouching such images.

Portraits or other images with a soft touch are best produced with a good soft focus filter over the regular camera lens. This approach gives you the possibility of using different focal length lenses, and the results can be as beautiful, or even better than those produced with a special soft focus lens. Select a filter that produces the same degree of softness at all lens apertures so you can set the aperture to the setting that provides the desired depth of field. Select a soft focus filter that maintains image sharpness.

The desired degree of softness depends on the subject, the use of the image, your personal preference, and somewhat on the lighting. A more directional light, which produces a higher lighting ratio with sharp-edged shadows, may call for a higher degree of softness than a subject lit with a softbox, which produces soft edged shadows. Light colored backgrounds are often more desirable as they reduce the possibility of halo effects, created by the lighted areas bleeding into the shaded parts, becoming visible or objectionable.

PRESS PHOTOGRAPHY

Convenience and speed of shooting are most important in news photography. An SLR camera with a built-in motor is a good choice, but a good rangefinder type can be even better. Motor drives are not as necessary as with 35 mm because medium format motor drives will not provide the shooting speed of several frames per second. Flash synchronization at all shutter speeds is very helpful or necessary in many news applications. Your camera should be rugged and solidly built.

SPORTS PHOTOGRAPHY

For the spectator who needs to photograph from the viewing stand, close-ups can be obtained only with long telephotos. A professional with a press pass can do sports photography with practically any medium format camera and a standard lens and telephoto short enough for handheld work or use with a monopod.

Zoom lenses are popular in 35 mm, but their limited zoom range limits their value somewhat in the medium format. Yet, zoom lenses are still helpful for composing a shot without changing lenses.

A monopod can be helpful. Train yourself to follow moving actions with the camera handheld as well as mounted with a long telephoto. A prism finder ensures that you move the SLR or TLR in the right direction when you are following action.

The slight delay between the time you are depressing the release and the exposure actually made in an SLR camera may have to be avoided when photographing actions. Use the SLR camera in a pre-released mode (with the mirror locked up) while viewing through a frame or sportsfinder. With rangefinder and TLR cameras, you don't have this delay, and there is no viewing blackout caused by the mirror moving up and down.

For professional results indoors, flash is necessary. To eliminate the ghost image caused by bright lights in an arena, you must be able to use shutter speeds up to 1/500 second. Therefore, flash synchronization at shutter speeds up to 1/500 second is a helpful feature. Electronic recording is used in news photography as the images can be transmitted immediately.

MEDICAL PHOTOGRAPHY

Medical photography can involve anything from photographing patients to copying and photomicrography. Much medical work involves producing slides for presentation, so you need to investigate the client's slide projection capabilities.

COMMERCIAL PHOTOGRAPHY

Commercial clients are critical, so high quality and consistency are foremost requirements. Lens quality, color rendition, film flatness, and shutter accuracy must be primary camera requirements. Using a Polaroid film magazine is the best way to ensure that you can accomplish the desired results. An SLR camera is the definite choice.

Special medium format camera models that allow increasing the range of sharpness by tilting the image plane in relation to the lens plane, have tremendously extended the possibilities and use of the medium format and roll film in commercial applications. By tilting the image plane, such cameras can be used with the medium format camera

lenses without requiring special lenses with increased covering power. While such a camera does not offer all the possibilities of a large format view camera, they are a great convenience, especially for location work. Check the amount of tilt capability—20° to 25° in either direction is sufficient for practically any application.

INDUSTRIAL PHOTOGRAPHY

The medium format camera is an ideal tool in the industrial field because industrial work can involve any type of photography from executive portraiture to commercial subjects and close-up photography. A versatile SLR type camera, with its extensive range of lenses and accessories, can meet any requirement.

A medium format camera is an excellent tool for the industrial photographer, whose work involves everything from portraiture to action to nuts-and-bolts close-ups. Photography by Mike Fletcher.

CREATIVE EXPERIMENTING

While practically any special effect can be created electronically after the image is recorded in the camera, there are still hundreds of ways to experiment with cameras and create images in black-and-white or color that are different from the way we see things with our eyes. For most experimenting, an SLR camera is a must. The rest of the equipment depends on your individual purpose. The more interchangeable components the camera allows for and the wider the choice of accessories, the greater are your possibilities. Almost regardless of what you try to do, a Polaroid magazine will be your most valuable accessory because it provides the only way to see effects and results.

SLIDE DUPLICATING

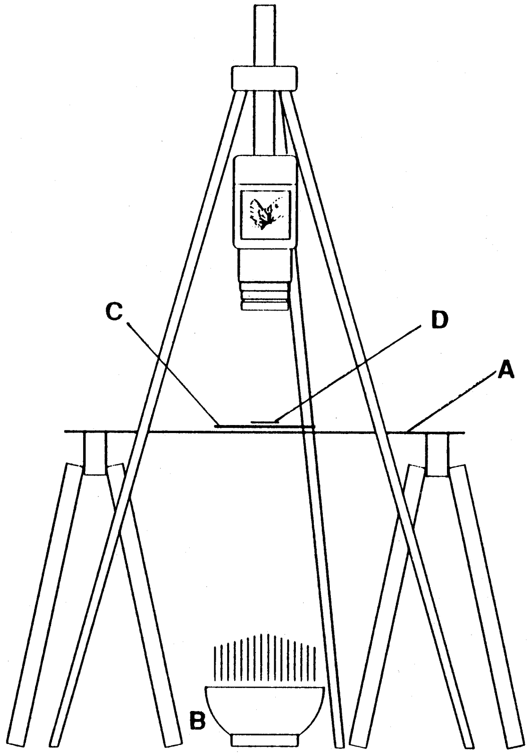
There can be many reasons for producing a duplicate of a slide: to protect the original against loss or damage; to have a duplicate in another size; to improve the original technically; or to create something new and different. While practically anything today can be created electronically in the computer, you might still find reasons for doing it in the camera, such as an improvement in the color rendition, composing the "dupe" differently from the original, making a black-and-white or color negative from the slide.

The most reliable and easiest-to-use slide duplicating setup is obtained when camera, lens, and slide holder are combined into one unit. Some medium format camera systems offer this possibility by combining a single lens reflex camera with bellows, bellows shade, and the transparency copyholder. The transparency copyholder has a diffusion glass to spread the light evenly over the slide.

Slides can also be photographed very successfully using a glass table. Place the transparency above the table on an opal glass, which diffuses the light. Use a black mask with a cutout in the size of the transparency to prevent unwanted light from shining directly into the lens.

Electronic flash is the recommended light source with either setup. The power of the light source and its distance from the slide determine the exposure. Photographing a slide is like photographing the actual subject. A dedicated flash system is highly recommended and should produce excellent exposures of properly exposed originals, and without the need to take a meter reading. With other approaches, an exposure test on Polaroid film is the best way to go.

Slide duplicating films would be best for duplicating slides, but they are not readily available, so you have to use the regular daylight color films.



This slide duplicating setup consists of a glass plate (A) at a convenient height above the ground; the electronic flash unit (B) is on the floor. An opal glass (C) on the table diffuses the light. The transparency (D) is on the opal glass. The camera is mounted on the tripod's reversed center post.

COPYING

Photographing documents requires the utmost in corner-to-corner quality. A lens with high acutance and corrected to provide the best image quality at close distances is the best choice. Camera alignment is vital: the image plane must be parallel to the copy. If the object to be photographed has definite parallel lines, align the camera as carefully as possible so that the lines are perfectly parallel to the edges of the viewing screen. A focusing screen with engraved vertical and horizontal lines (checked screen) simplifies alignment. A spirit level can be helpful when photographing vertical copy.

When camera and copy are aligned parallel to each other, focus the lens as accurately as possible. If the subject does not have fine details for precise focusing, place a substitute focusing target, such as fine newsprint, over the copy.

Since corner-to-corner sharpness is a foremost requirement, closing the aperture about two stops is suggested, unless you have a special flat field lens designed for this purpose.

Films and Filters

Regular black-and-white and color films are used for copying. If maximum contrast is desired in black-and-white, developing times should be increased by about 20 percent. Technical Pan film rated at 100 ASA and developed in D-19 for about five minutes at 70°F is excellent for high-contrast copy work.

When photographing colored originals on black-and-white film, you can use color filters to increase or reduce the contrast or to suppress or emphasize certain colors of the original. A yellow filter can be of value when you are photographing old, yellowed originals, as it will lighten the yellow background and, thereby, increase the contrast.

Lighting and Exposure

For small copy, one light may be sufficient; two or more are needed at equal distances and angles for larger copy. You can use electronic flash or Tungsten lights. Set the lights so that they shine on the copy from an angle of about 35° to 45°. Lighting must be even from corner to corner, and there should be no disturbing reflections. Use an exposure meter to check the lighting of different areas.

This is no problem with tungsten lights or with studio electronic flash units that have a modeling light and are ideal for this purpose.

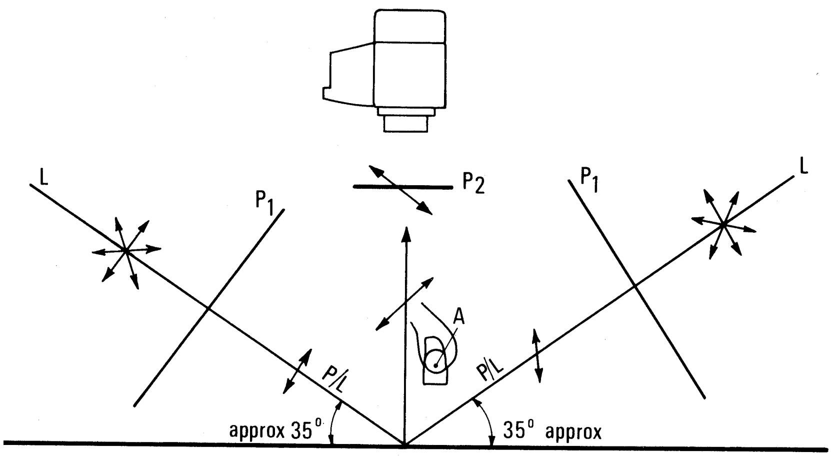
With any type of copy, determine accurate exposure either by placing an incident meter in the center of the copy and measuring the light falling on the copy or, if flash is used, by holding the flash meter over the copy. With a reflected light handheld or built-in meter, place a gray card over the copy and measure the light reflected off the card.

Use of Polarizing Filters

Copying results can be improved, often dramatically, with polarized light, which eliminates or reduces reflections and produces images with higher contrast and better color saturation. When photographing the copy straight on, a polarizing filter over the camera lens alone will not improve the results. The light that reaches the copy must be polarized. Polarizing filters must be placed over the light source or sources. They do not need to be high quality. Sheets of polarizing material are satisfactory, but keep them away from the hot tungsten lights. A regular polarizing filter, if large enough, can be placed over a small electronic flash head. If more than one filter is used, each must be rotated in the same direction in regards to polarization. If the filters are not marked, hold the two on top of each other, and look through them while turning

one of the sheets. You will notice that the view through the filters darkens and brightens as one of the sheets is turned. The filters are polarized in the same direction when the most light comes through. With the polarizing filter over the light source, turn the polarizing filter on the lens to the desired position where you have the maximum contrast and brightest colors while viewing the image in the viewfinder.

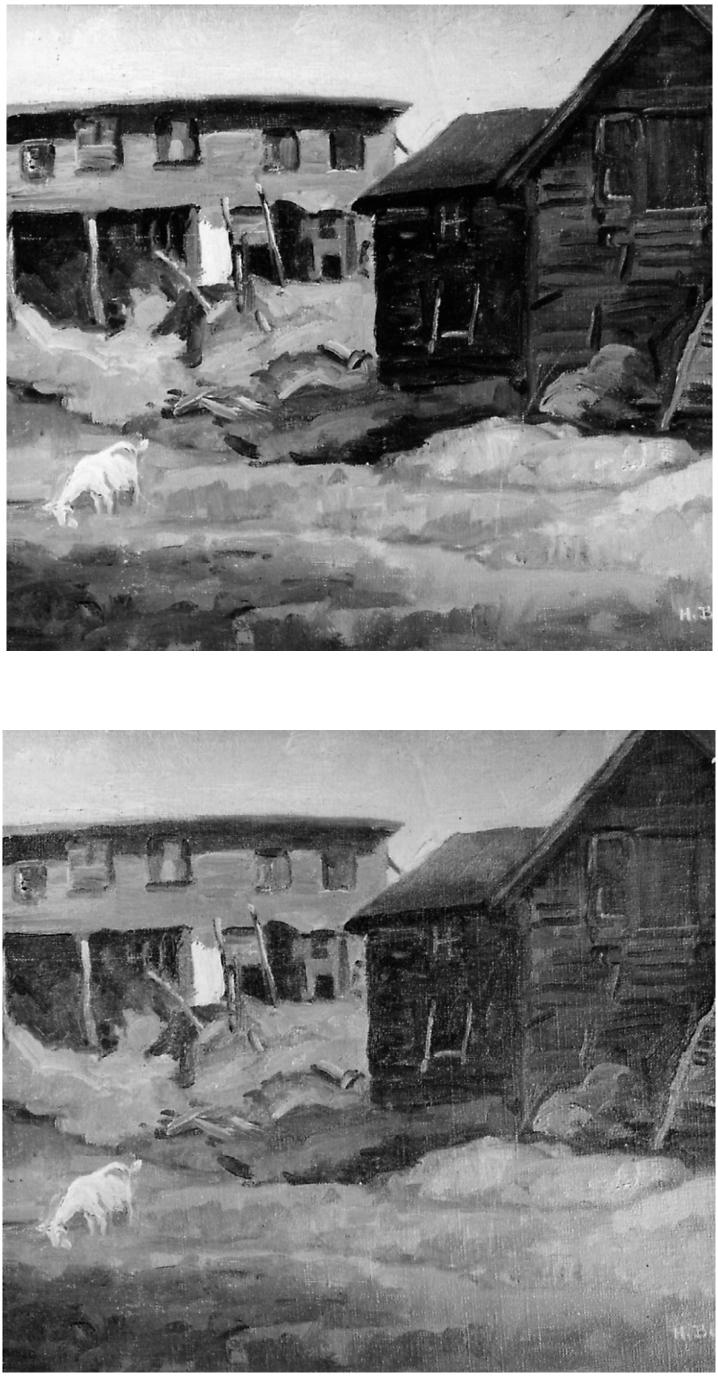
When you use polarized light, take the light reading with the polarizing filter over the lights. In addition, it is necessary to compensate for the polarizing filter on the lens if you are taking the light reading with a separate meter.



A simple setup for copying in polarized light consists of a copying stand or a sturdy tripod with the center post reversed so that the camera is held between the legs. Two lights (L), one on the left and the other on the right, illuminate the copy from the same angle. The light from both lamps goes through the polarizing filter or sheet (P1), so that the light falling on the copy is polarized. A polarizing filter (P2) on the camera lens is turned to produce maximum contrast. Exposure is based on a reflected meter reading (A) off a gray card placed on top of the copy or reading from an incident meter.

UNDERWATER PHOTOGRAPHY

Special medium format cameras for underwater work are not made, but underwater cases, both amateur and professional types, are available for some of the more compact camera types. In underwater photography, wide angle lenses are used mostly because the higher refractive index of water cuts down the angle of view. Correction lenses are available for professional underwater housings.



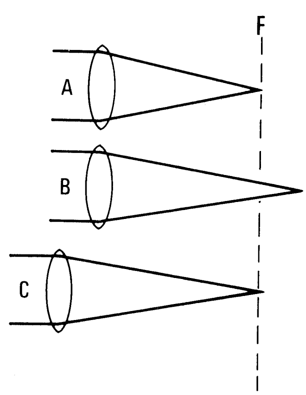
Copying in polarized light can greatly improve contrast and color saturation.

INFRARED PHOTOGRAPHY

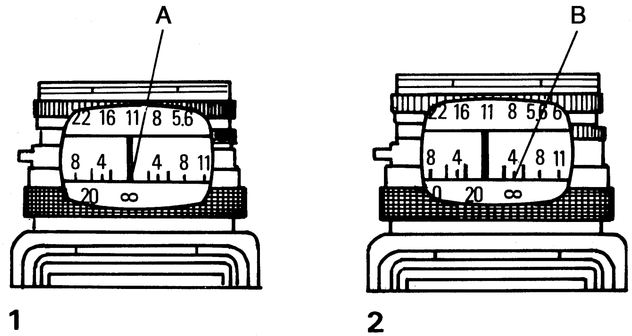
Infrared radiation, which is the invisible radiation with wavelengths beyond 700 nm, has important applications in scientific photography and exciting possibilities for those photographers who want to experiment with producing images with unusual colors or tonal renditions on black-and-white film.

Special infrared films must be used for infrared photography. Such medium format films for black-and-white photography are made but not readily available everywhere. Color infrared roll film is practically impossible to obtain or only on special order, which requires ordering a large quantity.

Practically all light sources can be used for infrared work. All photographic lenses transmit infrared radiation and, therefore, can be used for infrared work. Most lenses, however, are corrected only for the visible range of light and, therefore, only those wavelengths form the image on the image plane. The longer wavelengths of infrared form the image further from the lens and behind the image plane. This shift of focus presents no problem with color film because the image is not formed by infrared only. Images on infrared sensitive black-and-white film, on the other hand, will be out of focus unless you make a focus adjustment that amounts to about 1/200 of the lens's focal length. Many lenses have an infrared focusing index, which allows you to adjust for the aforementioned difference. There is at least one medium format lens, the 250 mm Carl Zeiss Superachromat that is chromatically corrected into the infrared range. This lens produces the best image quality in all infrared work and does so without a focus adjustment. Black-and-white infrared films are used together with a red filter. They produce beautiful outdoor images with an unusual range of gray tones. Green, for example, appears as white.



Infrared radiation (B) forms an image farther from the lens than does visible light (A). The image on the film plane (F) is, therefore, out of focus unless you compensate for this by moving the lens forward (C).



In infrared photography with lenses engraved with an IR index, focus the subject visually on the ground glass and read the distance (in this illustration, infinity) opposite the index line (A) (1). Turn the focusing ring so that the distance (infinity in this case) is opposite the red infrared index (B) (2).

ULTRAVIOLET PHOTOGRAPHY

Most ultraviolet photography (UV) photography is used in the medical and forensic fields, where the ultraviolet image can show things we cannot see with the naked eye, such as alterations on documents and restorations on paintings. Most of this work can be done at wavelengths of 320 nm or longer and, therefore, with regular black-and-white films and camera lenses. (Quartz lenses are necessary for shorter wavelengths.)

Color films can also be used for UV photography, but they offer no advantage over black-and-white, as only the blue-sensitive layer of film reacts to the UV radiation.

Consult a book on this subject for details about light sources and special camera techniques.

FLUORESCENCE PHOTOGRAPHY

Subjects that fluoresce when exposed to UV radiation can be photographed with any camera and lens because the fluorescent light that is reflected from the subject is ordinary visible light. The most frequently used light sources are the black light tubes, which are fluorescent tubes, engraved BLB.

Most electronic flash units can also be used since they produce a large amount of UV radiation. Most or all of the visible light must be absorbed by placing a filter over the flash tube. Use the Kodak #18A filter or a special filter made by the manufacturer of the flash equipment.

Only light from the visible part of the spectrum should be recorded on the film, so place a regular UV filter over the lens. The filter absorbs all radiation below 400 nm and reduces the bluish cast.

The striking color effects of this technique call for color film. Whether to use daylight or tungsten films is mainly a matter of personal preference. On daylight film, yellows and reds are more brilliant; tungsten light film accentuates the blues and greens.

Exposure can be determined with a regular meter, but film tests are suggested. A built-in meter that will measure the light through the UV absorbing filter on the lens is best.

CHAPTER 17

Slides and Slide Projection

PROJECTION FORMATS

Two and a quarter inch square (6 × 6 cm) and 6 × 4.5 cm slides made on 120, 220, or 70 mm film fit into 7 × 7 cm slide mounts for use in 2 1/4 in. slide projectors. Slides in the 6 × 7 cm format can be placed into 8.5 × 8.5 cm mounts for use in a special 6 × 7 slide projector. Larger slides can only be projected in a lantern slide projector. Special mounts with a panoramic cutout are also available as are slide mounts for the 40 × 40 mm superslides to fit the 35 mm slide trays. Today's 35 mm projectors, however, do not project superslides with satisfactory corner-to-corner illumination.

SLIDES AND SLIDE MOUNTING

Since the film surface of all medium format slides is large, glass mounting is highly recommended to avoid popping caused by the heat in the projector. Glass mounts also ensure a more reliable slide transport than cardboard mounts. Glass mounts protect slides physically but do not prolong their life or prevent the colors from fading. For longest life, slides should be kept in a dark, cool, dry place, or stored with a desiccant-like Silica Gel.

When glass-mounted slides are stored over longer periods, especially in places with higher humidity, the film base soaks up the moisture from the air. The heat from the projection lamp causes the moisture to evaporate and settle between glass and film, eventually clouding the

cover glass. The cloud may not be obvious when the image is projected on the screen, but it will reduce brilliance and contrast. Moisture that has settled between slide and glass should be removed as soon as possible to avoid the deforming of the slide and perhaps the growth of fungus. Take the slide apart and let it dry out before remounting. Clean the glasses with a glass cleaner. Most new slide mount glasses are factory cleaned and need nothing more than brushing off the dust.

To prevent or reduce fading, slides should not be exposed to the bright projection light longer than necessary. They should be kept in the dark as much as possible, especially away from direct sunlight and fluorescent lights (a light box, for instance), both of which have large amounts of ultraviolet rays.

For a faultless slide transport, the slide mount should be free of rough edges or sharp corners. The thickness of the mount is also important, because thick mounts cause problems in some projectors. Always squeeze the two slide frames together firmly. Do not attach tape or labels to the frame. Write information (numbers) directly on the frame with a permanent marking pen.

Medium format slides go into square mounts. They fit in the slide trays in every way so it is wise to mark the slide frame with a dot in one corner or a band along one side to ensure that the slides are placed in the tray in the proper position. Proper positioning is assured when the bands on all slides are visible on top or when all dots are visible in the same corner.

Newton Rings

Glass slide mounts may come plain or with a coating to avoid *Newton* rings, the rainbow-colored patterns caused by the contact of two extremely smooth surfaces such as the film and the glass. Newton rings in slides are objectionable because they may be visible in light areas when the slide is projected on the screen.

Newton rings can be avoided by using anti-Newton glass, which has a coating or etched pattern designed to prevent the rings. If only one of the two cover glasses has this coating, the shiny base side of the film must face this coating. If in doubt, hold the glass in such a way that a bright object is reflected on the glass. The reflection will appear with a sharp outline on the uncoated side and diffused on the coated side. The diffused side should face the base side of the film.

Pin Registration

Slide mounts for pin registration are available for most formats. The registration is achieved with registration holes that are punched into the slides with a special tool available from the slide mount manufacturer. The necessary tools for doing this are available. Pin registration means that two or more slides are mounted so the images are registered to each other when projected on the screen.

Mounts are also made with pegs for slides made on 70 mm perforated film. They serve pin registration purposes only with duplicates made on a 70 mm pin registered copy camera. Slides produced in a 70 mm camera film magazine are not registered in relation to the perforation holes.

SLIDE PROJECTORS

Slides in the 2 1/4 in. square and 4.5 × 6 cm format can be used in the same slide projectors and same slide trays, and thus can be intermixed within a slide presentation.

Projectors for the these film formats are available in different types: a completely manual projector, including the changing of slides; a projector that projects slides from a tray but is still a single-slide projector; and a professional machine that allows you to do everything that can be done in 35 mm, including the most sophisticated multi-image and multi-projector presentation. With such professional projectors, you can produce and arrange multi-image, multi-screen presentations as is done in 35 mm, but with the additional benefit of the larger slide, the much better image quality and image brightness, and the capability to project the image much larger.

Such professional projectors can most likely be operated with the identical programming equipment used in 35 mm. This compatibility offers the possibility of combining 35 mm and medium format slides in the same presentation. Check with the manufacturer regarding the programming requirements.

SLIDE PRESENTATIONS

Projection from a single projector is fine for home use or perhaps for some lectures. Consider, however, using at least two projectors with dissolve for anything more professional, even for lecture purposes. Adding one projector and dissolve makes the difference between an amateur and a professional show.

There are, of course, limits to what can be done even with two projectors. Double exposures are limited or impossible. You cannot change slides rapidly because you must wait until the slide in the projector is changed, which takes at least 1 1/2 seconds—rather long for a modern visual presentation. These limitations are eliminated when you use three projectors. Slides can be changed more rapidly, and double exposures can be made at any time.

Medium format slide shows with square images are especially effective. All square images fill the same area of the screen, in most cases the entire area of the square projection screen. With each square image filling the same area of the screen, viewers are only aware of the effectiveness of the image. They are not disturbed and bothered by the constant change of image format from horizontal to vertical and back to horizontal. With this constant change in format, you become overly

aware that you are looking at an image, not the real thing as is the case with squares. With square images, you become more involved in what you see as you do in an exciting movie.

Square images produce the most effective slide presentations with all the slides filling the same area of the screen (left). When you mix verticals and horizontals, the horizontals leave blank spaces on top and bottom of the square screen, and the verticals leave blank spaces on the two sides (right). The constant change from vertical to horizontal and vice versa is distracting for the viewers, who become overly aware that they are looking at a projected image.

For a multi-image presentation you must plan the production of the images. You need to visualize the combination of the projected images and photograph them so they combine visually and effectively in the projected presentation. You may need to repeat the same image or similar images, so shoot multiple exposures to avoid the need for making duplicates. For multi-image presentations, you may also need more than one image of a subject. You may need sequences of images taken from different angles and distances. You will probably discover that you need to shoot many more slides than you would for a print presentation or for a one-projector show.

CHAPTER 18

Maintaining Equipment and Materials

Keeping equipment clean is better than cleaning it. Keep all equipment away from dust and dirt whenever possible. When you store or carry a camera without a lens or magazine, the inside of the camera is completely exposed. Fit protective covers on the lens mount and the back, or store and carry your camera with lens and magazine attached.

CARRYING CASES

Cases are the best means of protecting camera equipment. For shipping equipment and placing it on planes in the baggage compartment, only shipping cases with partitions for the various items should be considered. Place additional padding in each compartment so that the items cannot move.

Larger shoulder cases that hold the camera and additional lenses and accessories are popular and practical. Other photographers prefer the suitcase type that must be laid down to open. Once it is laid down and opened, you can see everything that's in the case.

Either way, try to find a case that holds the camera complete with the items you normally use for your photography—the lens and lens shade, the viewfinder and film magazine attached to the body. It is too time consuming and inconvenient to assemble camera components every time you need to use your camera.

The case should be arranged so that each item can be stored in an orderly fashion and found instantly when needed. It is not likely that a case as it comes from the factory meets all these requirements. Cases need to be a compromise since almost every photographer has a different assortment of cameras, lenses, and accessories. The flexible compartment arrangement found in most cases today should allow every photographer to come up with a case that may look custom made for his or her camera system.

CLEANING THE CAMERA

Blow dust from small crevices with a brush or blower. You should take great care when dusting the mirror, viewing screen, or finders. Do not touch the focal plane curtains. Never use canned air; it is usually very cold and results in condensation, and the propellant agent may leave an oily residue. Cleaning the film magazines or film channel is important, especially making certain that there are no paper particles from the film roll anywhere lodged in the magazine. Focusing screens, and some filters and soft focus devices may be plastic or glass, and need special treatment.

Polaroid Film Magazine

The developing mechanism in the Polaroid magazine should be cleaned with a damp cloth after each film pack has been used, because chemical residue tends to accumulate on the rollers and may cause problems. If the magazine has a glass plate, clean it as you would a lens, especially when you are using negative/positive film. Dust marks on the negative may be very objectionable when the negative is enlarged.

Cleaning Lenses

Anti-reflection coatings are relatively hard but can be scratched by grit and other dirt on the lens surface. Before rubbing the surface of any lens with a tissue, blow away all loose particles of dust. Then use a soft brush, such as a special lens brush. Unless lenses have been touched with the fingers, no further cleaning should be necessary.

To remove a fingerprint or grease mark, breathe on the surface and quickly wipe it with a soft tissue. Then check to see if the surface is thoroughly clean by breathing on it once again. If the fingerprint is gone, the condensation will form an even deposit without spots and will evaporate gradually and evenly. If the element is still dirty, repeat the process with a drop or two of lens cleaning fluid on a lens tissue. Never put the fluid directly on the lens as it may find its way into the lens mount. Use lens-cleaning fluid sparingly. Do not clean lenses more than necessary. Image quality is not affected by dust particles.

ENVIRONMENTAL FACTORS

High Humidity

When working in areas of high humidity, especially in the morning, keep the camera in an area of the same temperature and humidity for some time, perhaps a half hour before you plan to take pictures. If you keep it in an air conditioned room or car, all glass surfaces fog up when the camera is taken into the high humidity area, making the camera completely unusable for perhaps as long as 20 minutes. All glass surfaces, not only in the lens but also the viewfinder, the focusing mirror, and screen, will keep fogging up regardless of how often you dry them until the surfaces have reached the same temperature as the surrounding air.

Fungus

When camera equipment is used in tropical climates or where humidity is high, clouding of glass surfaces, lenses, prisms, and filters often occurs after some time. This is caused by a microscopically fine network of fungi that attack the polished surface by etching their pattern into the glass.

Fungi develop at humidities of 80 percent or more. Humidity can be decreased by heating the air surrounding the camera equipment. Keep the camera in the sun or in circulating air; do not enclose it in an equipment bag or box without using a desiccant. Exposing the camera to direct sunlight is helpful. Do not store equipment in cupboards or drawers that are dark and lack air circulation. Do not cover cameras and lenses with plastic bags or hoods, which limit air circulation. If possible, have a fan blowing air on the equipment.

Nutritive substances, grease, and dust can also help fungi to develop. It is of paramount importance that all equipment be cleaned thoroughly after each use; especially fingerprints, grease, and dust must be removed from all glass surfaces. Pay special attention to lens mounts, eyepieces, mirrors, and the interior of the camera.

Humidity in small areas can be reduced with desiccants. Silica gel, usually in the form of small crystals in a dust-proof bag, is best for this purpose. Place the bag inside camera cases or containers, which should be airtight. Choose indicator gel that changes color from blue to pink when it reaches saturation point and needs regeneration. To regenerate, heat it at 120–150°C (250–300°F) for about 12 hours.

Cold Weather

Photography in cold weather is not only unpleasant for the photographer but also brings up problems in camera and battery operation that do not exist at normal temperatures. In cold climates, simplify camera

operation as much as possible. Remove any unnecessary accessories that cannot be operated with gloves or add accessories that allow easier operation. If possible, pre-load the film magazines before you go out in the cold.

Mounting cameras on tripods with tripod screws can be a frustrating experience in the cold. You will appreciate a tripod coupling in this setting. Once you are out in the cold, avoid touching unpainted metal surfaces with ungloved hands or your face or lips because your skin will stick to the metal. Do not breathe on lenses; the condensation will freeze, perhaps instantly, and it is very difficult to remove.

Condensation also occurs when cold equipment is brought into a warm room. This means that the chilled camera cannot be used indoors until its temperature equals that of its surroundings. A camera with condensation also cannot be taken out into the cold until the condensation has evaporated; otherwise the condensation will freeze. Condensation can cause very serious problems because it may also cover the camera and lens mechanism inside, and may freeze up the entire camera and lens operation; also interior camera parts may start to rust. It is possible to avoid this problem by placing the camera in an airtight plastic bag and squeezing out the air before entering a heated room from the cold.

The viscosity of lubricants increases (lubricants thicken) as the temperature declines. Consequently in cold weather, the camera mechanism operates more sluggishly, and mechanical reaction time increases with shutter speeds lengthening; for example, 1/4 second becomes effectively 1/2 second, especially if the lubricant in the lens and shutter is old and dirty. You will get better shutter operation if the lenses and shutters have been cleaned and lubricated recently. Quality camera and lens manufacturers today use lubricants that work down to low temperatures for the important elements in cameras and lenses. Winterizing is no longer necessary except in special cases. I also suggest that you operate all the shutter speeds a few times with the magazine removed or without film in the camera. This helps get the lubricants working.

Electronically controlled shutters are less affected by cold temperatures, but keep in mind that the opening and closing of the shutter is still a mechanical operation. Camera and lens manufacturers do not publicize specific temperatures at which equipment is guaranteed to work because temperature is only one aspect that can affect operation. Other equally important factors are the wind chill factor, humidity, the length of time the equipment is exposed to the elements, and how the equipment has been maintained.

All batteries lose efficiency at low temperatures, and fresh batteries may become too weak to operate the equipment after only a little use. Keep batteries in a warm place, and do not put them into the camera until they are needed, if that is possible and practical. Always carry a spare set and keep them warm (perhaps in a pocket) until they have to be used.

Some camera companies offer an accessory battery compartment that can be connected to the camera. This accessory allows you to operate the camera from a battery that is in warmer surroundings, perhaps under your jacket. Lithium batteries perform best in cold temperatures.

X-RAY INSPECTIONS

In addition to heat and humidity, fresh and exposed film can be damaged by X-rays and industrial gases, motor exhaust fumes, and vapors from paints, solvents, cleaners, and mothballs. Keep films away from X-rays, radium, or other radioactive materials.

The X-ray equipment used at all airports today and usually marked as being film-safe is not likely to produce any visible effect on normal speed (up to 400 ASA) films during a one-time inspection. Based on new tests with the modern equipment used at most airports, even multiple exposure (20$\times$ or more) of the same film did not cause any visible effects. Films of 1000 ASA and higher need a little more attention.

Most security officials at airports will honor your request for a hand inspection if they are not too busy and the inspection is made easy. You should ask nicely so that it sounds like a special favor rather than a demand. Take the rolls of film out of the boxes and place them in plastic bags. Perhaps even remove the wrapping from a few rolls of film. You are more likely to succeed with medium format roll film than 35 mm. The custom agent may assume that you must be a professional since you are using a more professional camera for this film, or just think that anything recorded on roll film must be more important than what people normally shoot on 35 mm. This is one more, if minor, advantage for working in the medium format.

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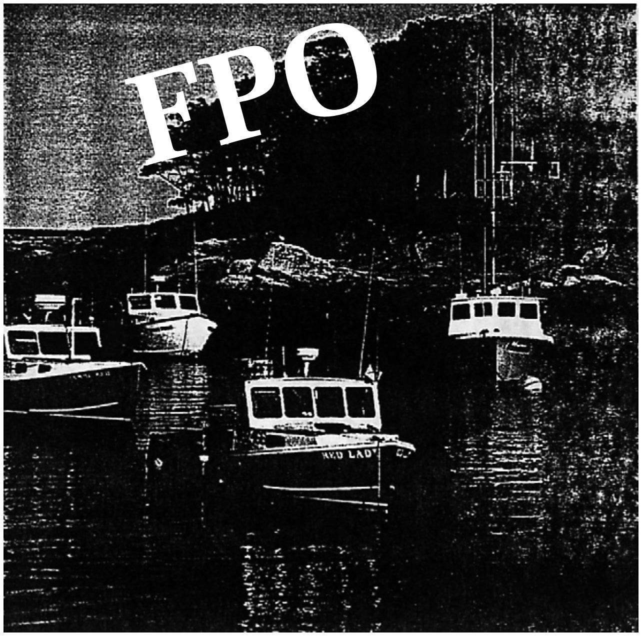
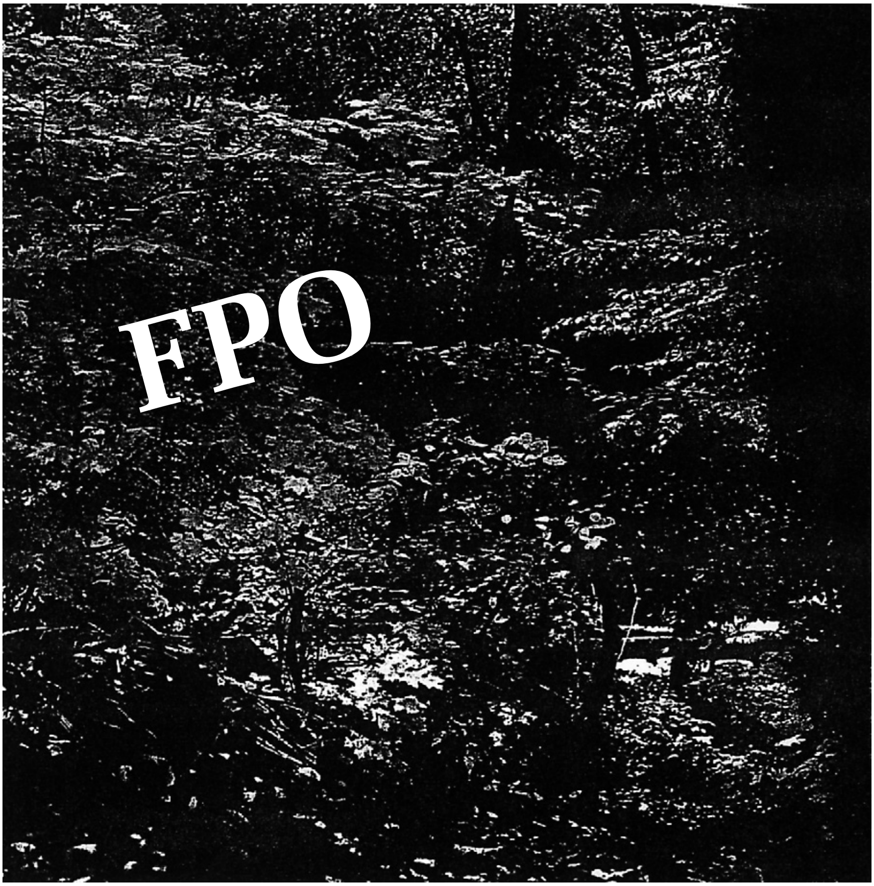
The flowers in the foreground are completely blurred by using a 250 mm lens wide open. They add a touch of color to the composition. The square format makes the outdoor setting an effective part of the composition. Photograph by Ernst Wildi.

Closing the aperture on the telphoto lens to $f32$ provides the desired maxium depth of field. Photograph by Ernst Wildi



Completely different moods and feelings are created on a bright, sunny day (top) and on a foggy morning (bottom). Photographs by Ernst Wildi

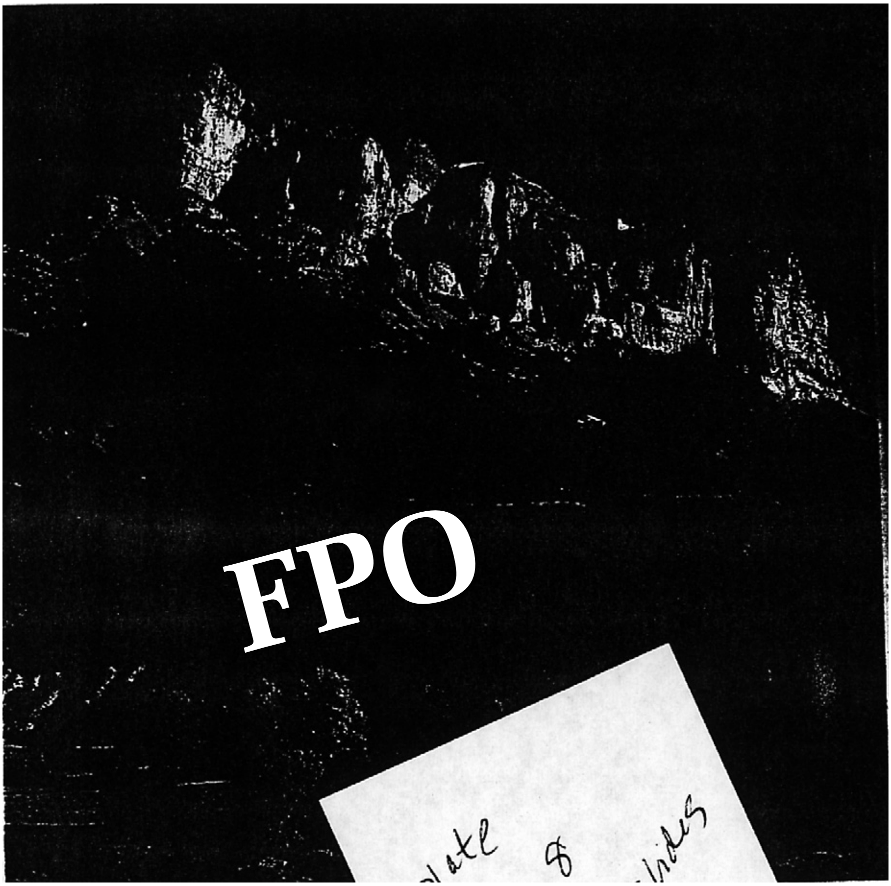


Overcast, rainy days add a beautiful mood and feeling to an outdoor setting and eliminate the need for worrying about the contrast between lighted and shaded areas. This is especially helpful when you are photographing in wooded areas. Photograph by Ernst Wildi

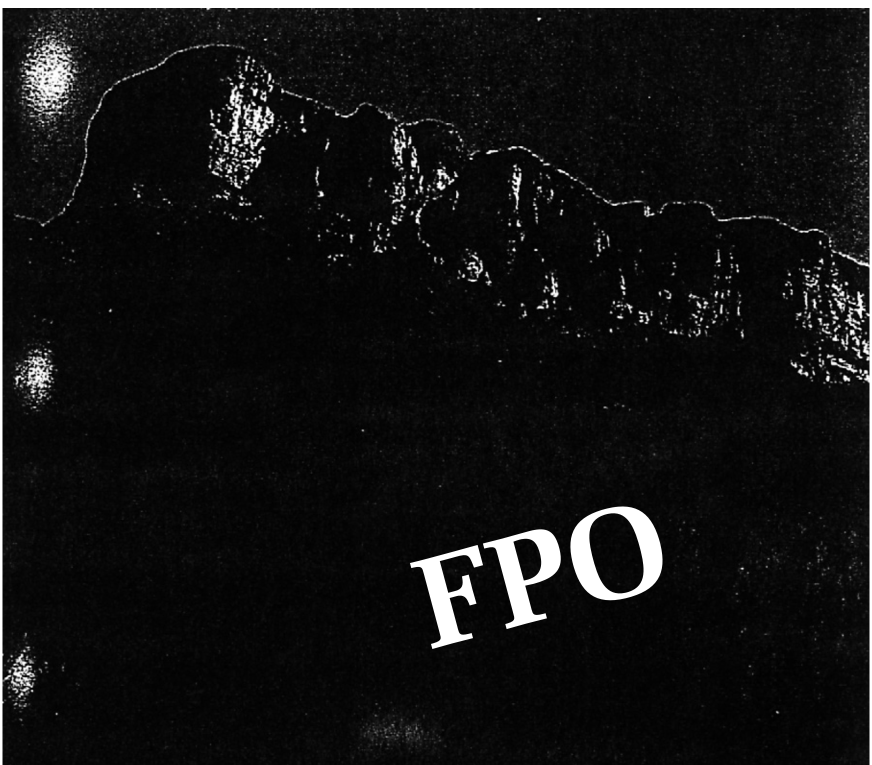
The evening sun provides dramatic lighting, effective shadow patterns, and beautiful warm colors in an ordinary outdoor location—here a swimming pool in Cyprus. Photograph by Ernst Wildi.

The medium format's main attraction is the superb image sharpness that is possible on today's high resolution films, and is more obvious on the larger image format. In combination with top quality lenses, the incredible line sharpness is maintained almost regardless of how much the original is enlarged. Photograph by Ernst Wildi.

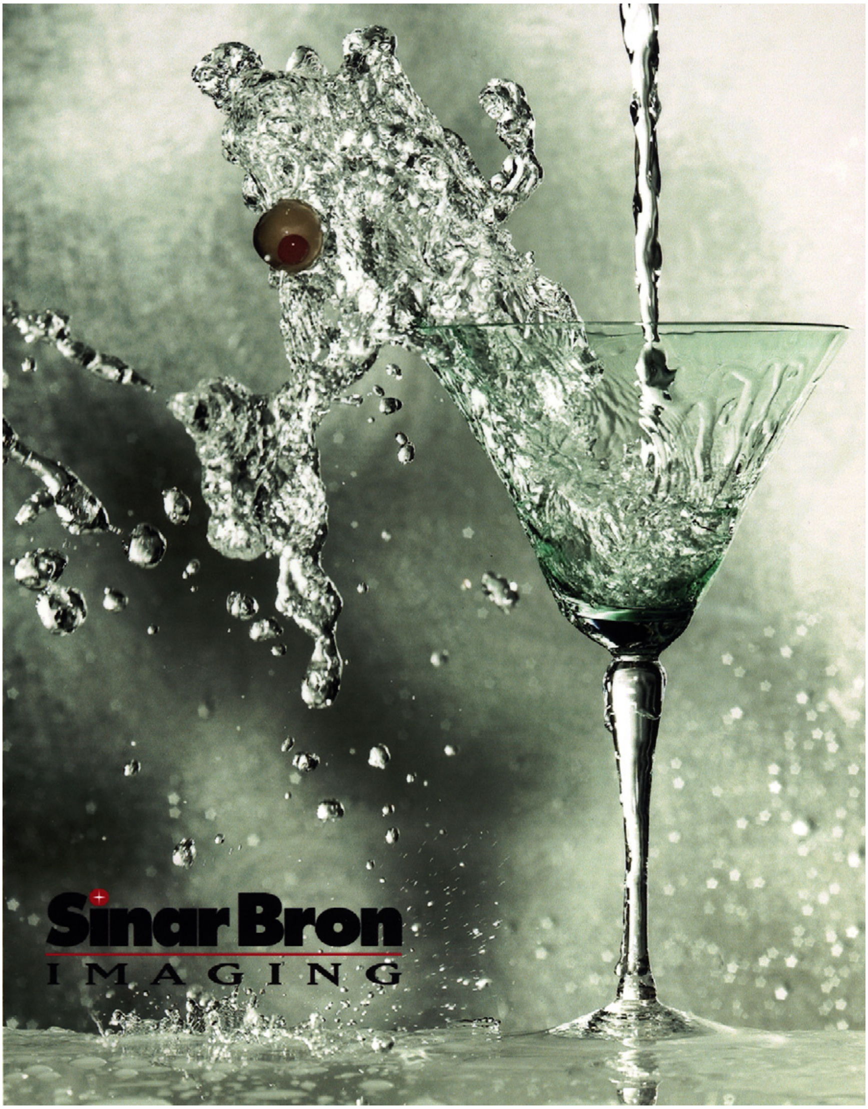
A compact, lightweight medium format camera can be used handheld for documentary work just like a 35 mm. Equipped with a large aperture lens, such work can be done even in low light levels. This photograph was taken at a flea market in Moscow with an $f/2$ aperture lens on ISO 400 film. Photograph by Ernst Wildi.



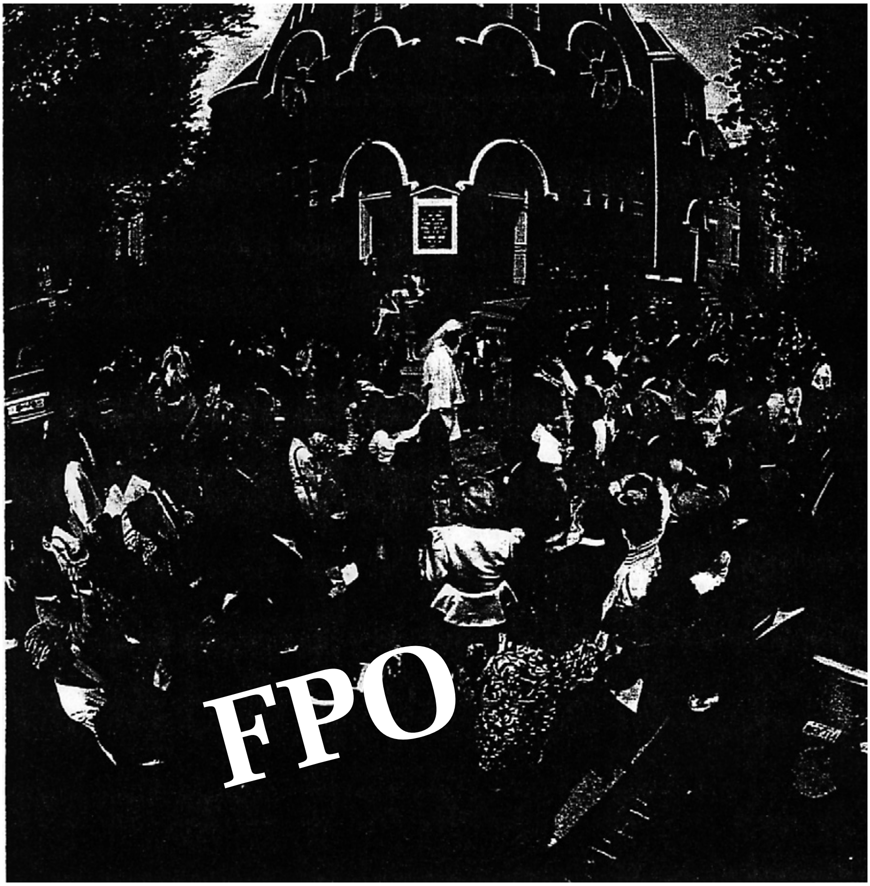
Polarizing filters can improve the color saturation drastically in distant shots, but only when the light comes from the side. Photographs by Ernst Wildi.


FPO

The square format can add to the effectiveness of location portraits and fashion shots by including more of the background area without reducing the size of the person. This approach gives such images the “true location look.” Filters can add a professional soft touch to images taken with any focal length lens. Carl Zeiss Softar #1 soft focus filter used on a short telephoto lens. Photograph by Ernst Wildi.

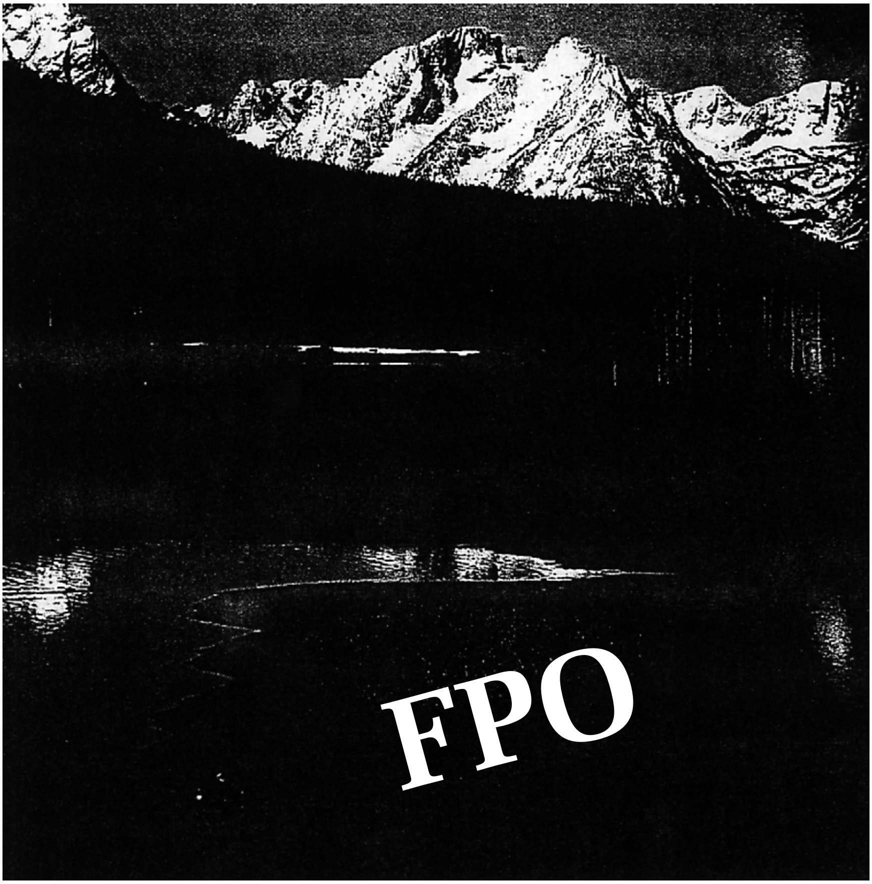


Digital image created at Red Kite studios with Sinarback proves the excellent image quality that can be obtained today in electronic imaging with a medium format camera.

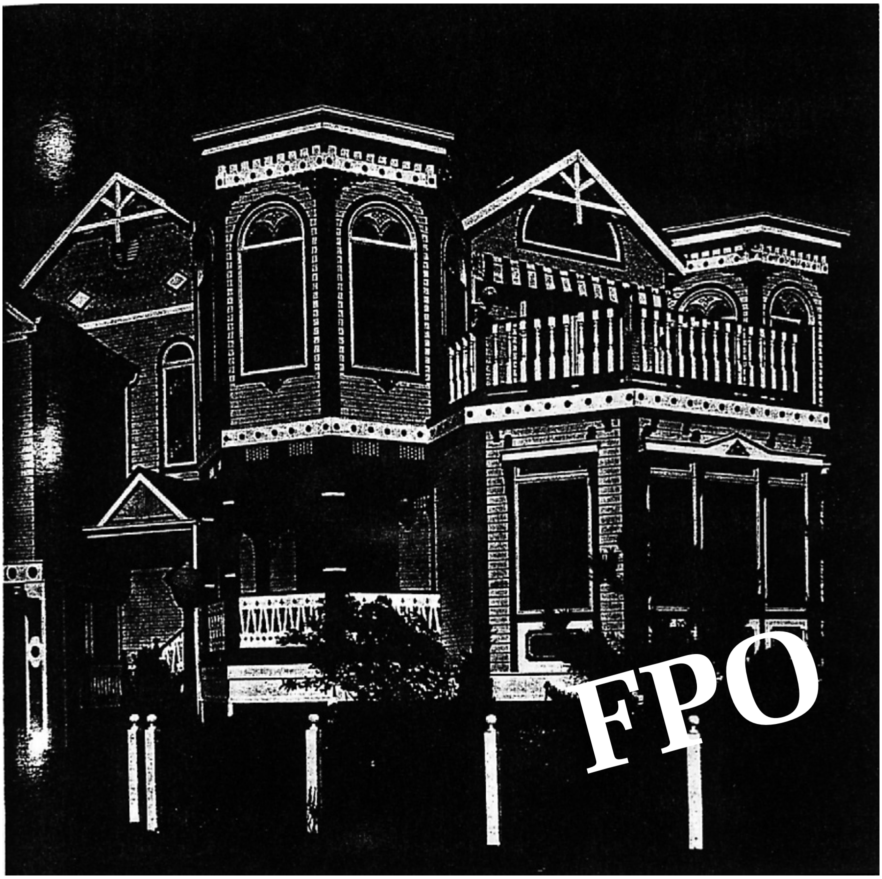


A full-frame fish-eye lens is not just for special effects but can also be an effective tool for creating that special picture for a special occasion without the typical "fish-eye distortion." Photograph by Monte and Clay.

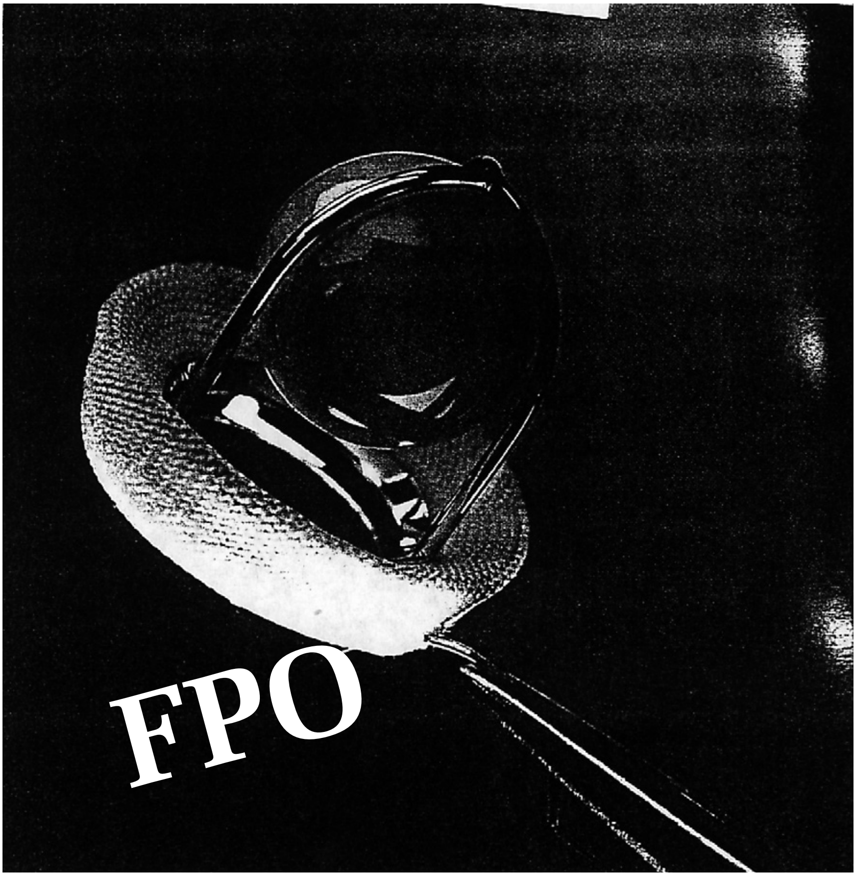
Digital image created by Jiri Vasa with a Phase One digital back. Such digital Images can be created by attaching a digital back to some of the same medium format cameras that are used for film photography.



Taken with a standard lens and 2× teleconverter. A small aperture also provides depth of field from foreground to background. Photograph by Ernst Wildi.



The medium format offers various possibilities for perspective control either by moving the lens or the image plane. Medium format cameras designed for this purpose provide a simple and inexpensive solution for professional architectural photography on roll film. Photograph by Ernst Wildi.



The possibilities for close-up photographs are unlimited with most medium format SLR cameras. Taken with an accessory bellows. Photograph by Harry Przekop.